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The Geographical Journal.

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The

Geographical Journal.

No. 4. OCTOBER, 1908. Vol. XXXII.

ON THE ROUTE OF BOLIVAR'S GREAT MARCH:* CARACAS TO BOGOTÁ VIÂ ARAUCA AND THE PARAMO OF PISVA.

By Prof. HIRAM BINGHAM.

In 1819 the armies of General Bolivar and Santander marched from the central Venezuelan *llanos*, crossed the Arauca river at Arauca and the Andes by the paramo of Pisva, defeated the Spaniards at Pantano de Vargas and the Bridge of Boyacá, and secured the independence of Colombia. I had always felt that the difficulties of this march, which has been likened to those of Hannibal and Napoleon, had been greatly overestimated. Anxious to learn the truth, I persuaded Dr. Hamilton Rice to assist me in an attempt to go from Caracas to Bogotá by way of this little-known region. We met in Caracas in December, 1906, and on January 3, 1907, started for Valencia by the German railway. Our outfit weighed about 1000 lbs., but the officials of this thrifty road made it weigh 1000 kilograms. A vigorous protest availed us nothing, and we were filched out of 325 bolivars (£13) for "excess luggage."

In Caracas we secured two West Indian negroes who knew some Spanish and rendered faithful service to the best of their ability in all sorts of ways until honourably discharged in Bogotá. In Valencia we added two faithful "peons" to our party. They walked across Venezuela in attendance upon our cart, the first wheeled vehicle to attempt such a journey. Besides the cart-mule we bought five saddle mules at

* "His passage of the Andes was a mightier feat than Hannibal's passage of the Alps; his marches were longer than those of Genghis Khan and Tamerlane; his audacity in risking battles against odds equalled Marlborough's, while his patience under reverses, his skill in leading dispirited, half-mutinous armies, and his never-failing ingenuity as a strategist, entitled him to the praise, somewhat grudgingly bestowed by Wellington, of being an extraordinary commander" (The *Times*, London, August 8, 1883). Map, p. 448.

prices ranging from £13 to £20. One of them lasted to the end of the march, and was sold for £6 the day we reached the Bogotá railroad.

PANORAMA OF THE BATTLEFIELD OF CARABOBO.

We left Valencia January 10, passed through Tocuyito, and camped for ten days near the battlefield of Carabobo. Several battles have been fought at this strategic point, where the roads from southern and western Venezuela unite. It is chiefly famous for being the site of the deciding conflict between Spain and Venezuela in 1821. So far as I have been able to discover, no map of the battlefield has hitherto been published. The region is very fertile, and supports quite a large population. The inhabitants are well fed, and fond of games — chiefly bowling and cock-fighting. In the woods are numerous birds, peccaries, venados (*Odocoileus gymnatus*), iguanas, and red squirrels (*Sciurus variabilis*). We saw no snakes anywhere in Venezuela except in the excellent zoological museum established by the Capuchin friars in Caracas.

We left Carabobo on January 21, passing through a hilly region over a wretched road that had been made by the late President Guzman Blanco. A new road leading from the plains of Carabobo to the central llanos was in course of construction. Beyond the hills lay the barren plain of Tinaquillo, where Bolivar reviewed his forces on June 23, 1821, before starting for the famous battle. The village of

Tinaquillo lies on the banks of the sluggish little Guayavita. The fare at the inns hereabouts is not bad, and consists of soup, beef stew, eggs, fried plantains, maize cakes, and excellent coffee. And so it continued with little variation until we reached Barinas.

From Tinaquillo, our road lay south over a barren range of hills, another plain, and then more hills, these last rather more fertile and consequently more populous. The next day brought us to the beautiful falls of Tinaco. Although not at all remarkable, except that they were the only falls seen in Venezuela, the surroundings are wild and picturesque. A ravine about half a mile long has been cut by the falls, which are at present about 10 and 40 feet high respectively. The river is well stocked with fish, which are caught in an ingenious manner by the lazy fishermen. Wherever the fish are accustomed to jump the rapids of the shorter falls, the fishermen suspend baskets, which catch those individuals that make poor leaps. About 8 miles beyond the falls the road climbs out of the valley and descends on to the plain of Tinaco, the northern limit of the great llanos. Here the road branches out east, west, and south. The town is unattractive, but there are numerous shops and a comfortable inn.

The next morning we turned westward. Our road now became a succession of grassy plains divided by wooded streams. The government telegraph-poles with their single wire were the only guide posts, but we found them quite sufficient as far as Barinas, the end of the line. We now began to see quantities of small wild pigeons (*Zenaida vinaceorufa*), green parroquets, and other birds of brilliant plumage, including macaws and parrots. About 13 miles beyond Tinaco we crossed a low, chapparal-covered ridge, and caught our first glimpse of San Carlos. In the time of Bolivar it was a place of great importance, boasted of 30,000 inhabitants and many wealthy citizens. To-day it has barely 3000 souls and a few interesting ruins. Earthquakes, revolutions, and cattle plagues have combined against it. A few companies of sad-eyed soldiers and a handful of *grafting* politicians hardly make up for its lost estate.

The ruins of the grand house where Bolivar is said to have been entertained shortly before the battle of Carabobo are most extensive, and cover a city block. Part of the outer walls are still standing. The corner room has recently been roofed over and turned into a butcher's shop. The ruins of another house not far away remind one of Italy, while those of the "Casa Blanqueria" are almost Pompeian. Painted frescoes, elaborate reliefs, carved wood ceilings, and tiled floors now shelter a polite but poverty-stricken family and their pigs and fowls. The exterior is decorated with caryatids that look like Incas.

We left San Carlos January 24, and entered a region of low foothills. The village of San Jose, 3 miles from San Carlos, has not twenty houses now standing, although it was once a place of some importance.

Beyond San Jose, the road crossed grassy savannas and wooded streams where bamboo thickets predominated. Occasionally one met wild bulls on their way to the bullfight. Each bull, with his head securely tied up in a sack, was attended by two or three *llaneros*, or cowboys. By a raw-hide lasso run through his nose the bull was fastened to the tail of a tame horse, on which rode the first *llanero*, whose mournful whistle, oft repeated, announced the approach of a wild animal. Another familiar sight on the roadside were the fires which the natives are fond of setting in the dry season. The dry grass and bushes burn rapidly for considerable distances, and at night look like lava-flows. This custom keeps down the rank prairie grasses and destroys the noxious insects and snakes.

At Camoruco, a hamlet of two or three houses, the western road divides, the left passing south of the last group of hills and going through the village of Cojedes, while the right road is the more direct and hilly route to Acarigua. We took the latter. The village of San Raphael has between twenty and thirty houses. Here the road from Cojedes to Barquisimeto crosses the western highway. Travellers to the Andean provinces turn to the right, unless they prefer the cart-road by way of Acarigua. A mile beyond San Raphael the road emerged from the hills, and we caught our first glimpse of the Cordillera. Occasionally an isolated hill cut us off from the plains, but for the most part the road skirted the llanos.

Agua Blanca, a small village with a couple of shops, is in the midst of a grazing country. But owing to revolutions and cattle plagues there are few cattle to be seen. In the 10 miles between Agua Blanca and Acarigua we were able to count but sixty-seven head, although the road leads over magnificent savannas that ought to support hundreds of cattle. On most maps Acarigua and Araure are some distance apart. As a matter of fact, they are practically contiguous, there being scarcely three-quarters of a mile of open land between them. Araure is much older, but stopped growing long ago, while Acarigua is the only place in the region that seems to be on the increase. It must have a population of nearly 3000. The cart-road to the Andean provinces goes north from here to Barquisimeto. Since the advent of the railroad at Barquisimeto, Acarigua has become somewhat of a distributing-point for the north-western llanos.

Most travellers who have made the overland journey from Caracas to Bogotá have gone *viâ* Barquisimeto, Merida, and Cucuta. A few have gone south from Caracas across the llanos *viâ* Calabozo and the Meta. But no one, so far as we were able to discover, had ever gone *viâ* the cities on the western edge of the llanos and Arauca. Accordingly we turned south from Acarigua, and passed through Aparicion, Ospino, San Raphael, Guanare, Tocupido, and Barrancas to Barinas before actually striking across the llanos. Aparicion has about twenty-five

inhabitants and a magnificent deserted plaza. Its one shop had quite a variety of goods, including cotton cloth, native hammocks, lager-beer from Caracas, "Extra Soda" biscuits from New York, "love-drops" from London, and water-melons from the proprietor's garden.

The region along the edge of the llanos from Tinaco to Guanare is a succession of savannas hardly ever more than three-quarters of a mile across, and wooded banks of streams, sometimes dry. As we rode south, we had on our right foothills in process of erosion, with occasional glimpses of the higher Andes; on our left the plains; but the vision was always bounded by wooded banks of winding streams, so

EL SALTO DE TINACO.

that the horizon was never far distant. At Ospino, a quiet, unpretentious little town, we found two young Venezuelans, who had been to Caracas, and spoke a little English. One of them, the local "sport," had a "pack of hounds"—consisting of three fox-terriers—with which, and a revolver, he told us he often hunted both deer and rabbits! In Valencia we had seen a real pack of a dozen hounds, and had enjoyed hunting with them, notwithstanding the fact that their owner assured us one of them was "an English pointer, *elevated* in Denmark." In the early mornings we now heard the curiously attractive roar of the red, howling monkeys, "araguatos." Blackbirds, meadow-larks, "scissor-birds," and large orioles were common. We saw hundreds of lizards, but never a snake. Cattle and horses were very scarce.

San Raphael in Zamora is a straggling village of thirty thatched

huts. The savannas are smaller here; the jungle more impressive. Occasionally we saw a few monkeys. The rivers are full of fish. At an inn near the Portuguesa we saw a kind of salmon being dried in the sun. It measured 40 inches from the tip of the tail to the neck. The head had been removed. So far we had no difficulty in fording the stream, although in the rainy season it is said to be impossible for carts to use this road. Between Carabobo and Guanare we met perhaps five carts a day loaded with hides. The drivers were intelligent, hard-working peons, whose ability to guide their mules over the rough places in the "road" is quite extraordinary.

Five miles beyond the Rio Portuguesa is Guanare, to which the latest official statistics give a population of 30,000. We could not account for more than 2000 on the most liberal allowance for families. There are not more than six very small shops. The plaza is attractive, and the house in which Bolivar is said to have stayed has many signs of having been built by a wealthy man. We had a letter of credit from a German mercantile house in Valencia to the rich man of the town, who was most obliging, and furnished us with £50 in gold and silver without any difficulty whatever. There is a small college here conducted by priests. A league south of the city is the river Guanare, a magnificent stream, filled with islands and flanked by great jungles. In one tree on its bank we counted sixty-three egrets. Water-fowl are more numerous as one goes south. In fact, the fauna changes rather markedly after crossing the Guanare. Perhaps the reason is that the country is wilder. Few carts ever pass the Guanare, and the rarer animals are less wild. But flies and midgets were very troublesome.

Tocupido, once a thriving town with a large church built of masonry, is now a village of only forty thatched huts and a small thatched church. In order to get the cart across the Bocono we left the vicinity of the foothills and went across the plains towards Sabaneta. Even at this ford the sandy bottom is said to be treacherous, but the mule had no difficulty in pulling the empty cart across, while we were ferried over in a dug-out canoe about 25 feet long. The river was not over 4 feet deep. Sabaneta, 6 miles beyond the river, is a village of possibly fifty thatched huts. The people here were very friendly, and greatly enjoyed the novelty of our proceedings. In the course of the evening Rice got out his theodolite as usual to make a stellar observation, one of our men gave an exhibition of taxidermy, while I was busy in a dark corner of the living-room of the little inn changing my photographic plates.

In order to reach Barinas we now had to turn slightly north of west and follow the flood plain of the Bocono for 10 miles, until we reached the old trail near the foothills. Our road lay through the great forest jungle that lies for miles on each side of the Bocono. Trees with a

girth of 20 feet are not uncommon. I measured one whose girth was 26 feet, and whose spread was over 200 feet. Flocks of monkeys, quantities of birds, thousands of insects, and millions of ants made the day one long to be remembered. At one place on the sandy trail the ants had formed a living causeway over the fine sand of the path, in order to facilitate the great speed at which the majority wished to travel. The causeway was over 2 inches wide, and from one to three ants deep. So firmly did the "bridgeites" hold together, I lifted the causeway 4 inches from the ground by thrusting a stick underneath, without breaking their formation.

Our next stop was at Barrancas, a small village of twenty huts. From here to Barinas we had once more the familiar small savannas, low hills, heavily wooded river flood plains, few cattle, and almost no horses. For lunch we shot some guans, which the natives call *guacharaca* (*chaoholaca*). They need considerable cooking, but are palatable. Underestimating the distance to Barinas, we did not reach the ford over the Santo Domingo until long after dark. It is a rushing, roaring torrent, much like the Guanare, and we had considerable difficulty in finding a safe way across.

The most interesting ruin in Barinas is that of "El Marquez," a fine house, built about 1800 by a cattle king. It measures 138 feet by 114 feet. A charming patio, surrounded by graceful columns and surmounted by an attractive balustrade, gives a glimpse of the life here in the days of dependence on Spain. The owner is said to have been a loyalist, and was ennobled by his king and ruined by his countrymen. Barinas was once an important place, but the decay of the cattle industry has destroyed its greatness, and it can hardly boast of more than two thousand inhabitants to-day. The telegraph line ends here, and carts very rarely attempt to go any farther. Two years ago one went to Pedraza. We had intended to go to Pedraza, near which are some interesting Indian ruins, but we found that the only way for the cart to reach the Colombian frontier was for us to go *viâ* San Sylvestre (Totomal), Acanagua, La Boca Suripa, Palmarito, and Periquera (Nueva Guasdualito). We now had to employ local guides from place to place.

Soon after leaving Barinas we lost sight of the mountains, and did not see them again for many weeks. The savannas grew larger and larger, until occasionally they seemed almost without limit. Several varieties of ducks and red deer constituted our daily bag for some time. We saw a great many water-fowl, egrets, ibis, herons, and jabirus. The last are magnificent storks, standing 4 or 5 feet in height, and with a spread of 7 to 8 feet from tip to tip of wing. "Goatsuckers," or "nightjars," lapwings, and many other birds make this a paradise for the ornithologist.

At the Paguei, a river resembling the Bocono, we were ferried across in a dugout. On its south bank lies San Sylvestre, formerly

Totomal, a poverty-stricken collection of a dozen thatched huts. We were now in the llanos of Apure, the home of the great President, General Paez. We stayed for several days at La Calzada, a ranch where he had lived as a boy. It is now owned by a thrifty Colombian, who raises sugar-cane, maize, yucca, potatoes, tobacco, and four varieties of beans. With a thousand head of cattle, nine leagues of land, a dozen house servants, and a few books, he lives far more comfortably than any of his neighbours. They rarely have any vegetables, except plantains.

The temperature on February 8 varied from 64° Fahr. at 6 a.m. to 80° at 9 a.m., 86° Fahr. at noon, 89° Fahr. at 3 p.m., 82° Fahr. at 6 p.m., and 77° Fahr. at 9 p.m. This was an average day. The thermometer hung in the shade of the thatched roof. At sunrise there was no breeze. But it began at 6.30, grew stronger, and blew very fresh from 8 to 10, dying down at noon, and being very light and fitful in the afternoon. This was characteristic of our weather for a fortnight. This daily breeze from the north-east is the salvation of the hot plains. It makes it possible to work with comfort during the morning. Of course, one is supposed to sleep in the afternoon.

We crossed the Apure river at Boca Suripa, its juncture with the Suripa. The Apure was until recently the larger of the two rivers, but the Caparro has left its old bed some distance above Mamporal, and now empties into the Suripa above Sta. Rosalia, so that the latter stream has become larger than the Apure. This change in volume and force of the current is altering the region by creating new islands and destroying old ones. We saw more large alligators in the Suripa just above Boca than anywhere else in our journey. A canoe ferry is maintained here, and it is a favourite place for swimming cattle across the river. Our cart was placed, empty, amidships of a large dugout canoe, and safely navigated across the swift current. After crossing the Apure we found ourselves on the route followed by Bolivar's soldiers in their famous march of 1819. I left the caravan for two days to go up the Apure in a canoe, and joined Rice at Palmarito. I found my head-net and gauntlets of great use on the river, as the flies were a perfect plague.

We saw quantities of birds on the Apure, including two "king buzzards." They were twice as large as the common "Samur," had red heads, white bodies, white wings tipped with black, and black tails —quite regal-looking vultures.

A small river steamer comes up the Apure as far as Palmarito and Periquera in the wet season, from May to November. The result is that many of the houses have corrugated galvanized iron roofs instead of the picturesque thatch. In the dry season the principal business is the handling and shipping of cattle; but in the wet season, when it is almost impossible to handle cattle, the cowboys become bird-catchers, and penetrate the flooded jungles in canoes in search of the precious

egrets. A river trip down the Apure at this season of the year is not pleasant, for the wind blows so strongly up-stream in the morning that the canoes are often obliged to wait until the hottest part of the day (eleven to four), when the flies are at their worst. Going up-stream the conditions are reversed. One can sail for about three hours, enjoy the breeze, the absence of flies, and the cessation of labour on the part of the crew, who make slow work poling against the current. At night we camped on a sandspit, suspending our hammocks from drift-wood poles planted in the sand. The soil along the banks of the river seemed to be a mixture of clay and gravel. I rejoined the caravan

THE BATTLEFIELD OF BOYACA.

at Palmarito, a thriving little town of, perhaps, fifty houses. The most enterprising shopkeepers here are Syrians.

After leaving Palmarito we did not again see the Apure, although we paralleled it as far as Periquera. The country is quite wild, and one sees very few cattle. An occasional armadillo, red deer, ducks, jabirus, and golden agutis (or *pagaris*) are fairly common. Here we first noticed a mirage about noon. It extended for a distance of nearly 3 miles. The trees did not appear to be inverted, but rather raised completely from the plain. In the wet season the plains are a great swamp, which in the dry season looks in places like a frozen mud honeycomb. This makes the trail very rough for the cart. The poor cart-mule became quite exhausted, and the two peons who walked with the cart all the way from Valencia got very much discouraged. The people hereabouts differ from those in the cities of the north-west

llanos in being less suspicious, more inquisitive, less modest, more lazy, less honest, and much more hospitable. They appear to be a mixture of Spanish and Indian blood. One rarely sees any evidences of negro blood.

As we approached Periquera the savannas grew smaller, the chapparal increased, swamps became more frequent, and we lost the familiar sweep of the great plains. We found the road into the town so corrugated by the feet of animals in the wet season that it was quite impassable for the cart, which had to skirt the town and pass over the site of Guasdualito. Part of the church walls are all that remains. When steam navigation began on the Apure, its inhabitants moved over to the swamps near the river and built up Nueva Guasdualito, more commonly called Periquera.

On February 19 we arrived at El Amparo, and looked across the Arauca to the Republic of Colombia. El Amparo is a village of about fifty houses, some thatched and some with corrugated iron roofs, which testifies that it is a port of call for river steamers on the Arauca. The temperature here on February 20, in the shade under the eaves of our boarding-house, was 71° Fahr. at 6 a.m., 85° Fahr. at 9 a.m , 93° Fahr. at noon, 95° Fahr. at 2.30 p.m., 86° Fahr. at 5 p.m., and 79° Fahr. at 9 p.m. The chief articles of export here are hides and feathers. After some difficulty with the authorities, who took us for revolutionists and insisted that we had too many guns, we finally left Venezuela on February 22, and bade adieu to the cart and our faithful peons. They eventually got the cart back to Valencia and the mule actually lived to complete his 900-mile journey.

We spent a week in the town of Arauca, where we were most courteously entertained by the Government authorities, acting under orders from President Reyes. His kindness repeatedly made our journey in Colombia easier and more comfortable. Arauca appears to be as prosperous as the other river towns, although we were told its importance has much diminished since the Venezuelan Government closed the Orinoco, forcing all goods bound for Colombia *viâ* Arauca to pay Venezuelan duties at Ciudad Bolivar besides the Colombian customs at Arauca. One sees no Colombian paper money here. Venezuelan silver is the current medium of exchange. Colombian silver is worked off on strangers. Unable to secure any other pack-animals, we bought four oxen, which carried 225 lbs. apiece and walked 2 miles an hour without difficulty. These lasted us until we reached the mountains at Pore.

The usual way to go from Arauca to Bogotá is *viâ* Cucuta. The army of Bolivar, however, went directly to Tame, thence along the western edge of the llanos of Casanare to Pore, and from there by the paramo of Pisva to the Sogamoso valley. This route leads for the first 125 miles through a very wild region, inhabited only by savage Indians. Consequently it is avoided by the Colombians, and it was only after many

trials that we secured a guide who knew the way. Those who have business in Tame go *viâ* Cravo, and our guide was very insistent that this was the only feasible route. We finally forced him to go "Bolivar's way," but he had his revenge in the difficulties we had to encounter.

We left Arauca February 29. The country in its immediate vicinity swarms with cattle and horses. We saw more stock here in one day than in all our journey across Venezuela. The next day we reached the last ranch before the "wilderness," just in time to escape a heavy thunder shower, our first rain in two months. Here we were detained several days by the loss of two oxen, which broke loose in the night and

MAKING A CHINCHORA HAMMOCK AT EL LIMBO RANCH.

returned to Arauca. The temperature on March 1 was 73° Fahr. at 6 a.m., 86° Fahr. at noon, 89° Fahr. at 3 p.m., 80° Fahr. at 6 p.m., and 76° Fahr. at 9 p.m. A few streams meander through the llanos here, and have cut so deep a channel that they have no flood plain and consequently no jungle. We saw nothing like these in Venezuela. The streams are the home of countless capybaras and small alligators. The ranch owner had many hundred head of cattle, rather more than the pasturage justified. As it was the end of the dry season, the grass was very poor and many of the cattle had died.

While we were delayed at the ranch, eight wild Indians (*Indios bravos, muy bravos*)—four men, three women, and a baby—arrived with the purpose of trading hammocks and twine in exchange for some large dogs that were raised here. The men wore nothing but breechclouts, and the women were not much better off. The men were armed with bows,

iron-pointed arrows, and spears. The chief was inclined to be friendly, but the younger ones were rather sulky. The babies are carried in a small hammock slung over the mother's shoulder. We saw more members of this tribe after leaving the ranch. The Colombians are very much afraid of them, but they seemed quite friendly and peaceable. They speak but half a dozen words of Spanish, so our communication with them had to be largely by signs. They could none of them look one in the eye.

After crossing the river Lipa, which we forded without difficulty, we saw no more cattle until we reached the ranch called "Limbo," which is a day's ride from Tame. The savannas were covered with long grass. Sometimes it was higher than our heads as we rode. There was generally no trail to be seen anywhere, although once in a while we would cross an Indian path, or follow it for a short distance. The river Ele, 150 feet wide and 12 deep, would have forced us to build a raft had we not been able to secure a canoe from the Indians, who had a small village near the crossing-place. Our guide said they were Yaruros or Guajivos. Many of the men had had the lobes of their ears pierced. They reminded me strongly of Gilbert islanders. Many of the Venezuelan mestizos bear a striking resemblance to the mixture of Caucasian and Polynesian that one sees in the Pacific ocean.

Beyond the Ele the country was very wild and deserted. Almost no animals were to be seen, except occasionally a big stork standing alone in a marsh. The common ones are about 3 feet high, have a white breast, black tail and tips of wings, white head, neck, and wings, reddish spot around the eyes, whitish beak with a barb on top. The deer are far wilder here than in Venezuela. The Indians take the trouble to hunt them, while the Venezuelans are too lazy and prefer beef. The region is very swampy, even at the end of the dry season, while it must be practically impassable in the winter. The natives say that Bolivar's army used canoes, but this hardly seems likely; more probably they had to wade. To avoid one very bad swamp, we were obliged to follow the guide for 300 yards through a lagoon 4 feet deep. One of the mules lay down in the water, and was rescued only with the greatest difficulty. The next day another mule became hopelessly stuck in a bog, and finally had to be shot.

In the jungles of the Cravo river we passed through a deserted Indian village of twenty huts, or rather palm-leaf shelters, the largest 9 feet long and 6 feet high. The only food in the vicinity appeared to be the variety of palm that serves for thatching the houses all over the llanos, and which has a small date, of which monkeys are very fond. The guide said the Guajivos came here to avoid the floods. We saw no jaguars anywhere, but there was fresh spoor on the bank of the Cravo river, where we found a fording-place. The swamps now became much worse and more extensive, so that we progressed with great difficulty.

The oxen got very tired, and made for the dense jungle whenever they got a chance. Near the Cravo I saw several horned screamers (*Palamedia cornuta*), lapwings (*Belonopterus cayennensis*), grey herons, red and white ibis, egrets, several varieties of ducks, and the rosette spoonbill. Of quadrupeds the golden agouti and the venado were all we could see, and these very seldom, owing to the high grass.

About 4 miles from "Limbo," the first ranch on the west side of the wilderness, we came to the Caño Guato, an affluent of the Totumito. Recent rains had made it overflow its banks, so that for 2 miles the country was so drowned as to be impassable. We had to wait for three

THE PLATEAU AND VALLEY OF SOGAMOSO.

days until the floods had subsided sufficiently for us to reach its banks and effect a crossing. A boy from "Limbo," who came to help us, was bitten in the calf of the leg by a caribe. The wound was the size of a dollar, and proved to be very painful. As the little stream was over 10 feet deep, and its banks were 2 feet under water, the fording was not an easy matter. After breaking camp, it took us from 10 a.m. until 2 o'clock the following morning to cover the 4 miles to "Limbo." Our food-supply was nearly at an end, and we were glad enough to rest for several days at this hospitable ranch. Milk, cheese, plantains, and coffee never tasted better. The previous day I had shot two horned screamers, but the meat proved to be almost unfit for food, and made the men vomit. The larger bird measured 6 feet 8 inches from tip to tip of wing. The feet were like turkeys'. The wings had two pairs of spurs,

and the feather-bone horn on the head was over 3 inches long. "Limbo" belonged for twenty years to the revolutionary General Vargas. A souvenir of his ownership is a great wooden trough, in which he lay concealed for several days while the Government soldiers searched for him.

From Limbo we turned south-west to Casanare. The first day we saw nineteen deer, more than any day heretofore. They were excessively wild—began to run while we were half a mile away—so that it was quite impossible to get a shot at them. At noon we caught our first glimpse of the Andes since leaving Barinas. We saw no high peaks, only foothills rising 500 feet above the level of the plain. At the end of the day, March 16, we reached Casanare (Puerto San Salvador), and had a most unhospitable reception. We practically had to force an entrance into the enclosure of the posada. The people were very suspicious of our guns, and also of our guide, who was a noted thief. The village has but twenty huts, but is quite famous in history, as it was the headquarters of General Santander at that period of the Colombian war of Independence, when Spain had regained control of everything except the llanos of Casanare. The place now serves as a depôt for coffee, which is shipped in bungoes (large canoes) down the Casanare to the Meta.

The fauna and flora here are like that near Guanare. Lizards were abundant, although we had not seen one for six weeks. There are no deer to be seen. Macaws and parrots are common, and so is a scavengering ibis called "boca." The region between Casanare and Corrazales is fairly well wooded. The most unusual tree was a small palm, 15 feet high, 3 to 4 inches in diameter, having truncated leaves like a "wine palm," and bearing a cluster of brilliant red berries like cherries, resembling in size and shape a large bunch of grapes. We saw no pebbles by the roadside or in the streams all the while we were in the llanos proper, from Barinas to Casanare. The plain appears to end abruptly at the foothills, but there is in reality a gradual rise of 2 or 3 miles to the hills.

Corrazales is a small village of thirty houses. The innkeeper did not like our looks, and denied the existence of food or lodging. Again we had to resort to compulsion. On March 18 Corrazales enjoyed its first shower of the year. The only money desired here is "billetes," the Colombian paper, which is at 10,000 per cent. discount. A Colombian nickel coin was refused in payment for a spool of thread. Here we saw the first stone wall seen since leaving New England.

Chire is a dirty little village of about thirty huts. We were accommodated in a new house, and were not told until afterwards that the owner had died of small-pox and been buried the day before our arrival. Potatoes, very small but quite palatable, are a common article of diet from here on to Bogotá. On March 19 we had a small shower. The

road between Chire and Moreno lies very close to the foothills, which are about 600 feet high, and seemed to be composed entirely of pebbles and boulders. Before reaching Moreno the road winds among hills which have little soil, support almost no trees, and are not dissected by erosion to any extent. The angle of the hills is about as steep as a pile of pebbles could be made to assume. The largest boulder seen was not over 3 feet in its greatest diameter. Occasionally we met small herds of oxen laden with bags of coffee from the hills near Tamara and Ten, bound for Casanare. A mirage, seen March 19, six hours before reaching Moreno, seemed to be an inverted image. It lay east-south-east from the road about noon.

The river Ariporo resembles the Guanare in appearance. It has cut

BOCA DE SURIFA FROM THE LEFT BANK OF THE RIO AZURE.

a beautiful terraced valley through the hills. There seems to be a second range of hills running north and south between the foothills and the mountains. Shortly before reaching Moreno the road climbed a slight hill, and disclosed a wonderful view. The valley of the Ariporo lay before us and above us. The high Andes shone in the sunset above the clouds to the north-west. With the glasses we made out two glaciers on the south side of one peak, and a large glacier on another. These must be near Cocui and Conception.

During the night of March 19, a heavy shower fell while we were in Moreno. More rain fell the following morning. It appeared to be the first of the season, and an intelligent resident of Moreno told me they had no rain from December to February. Beginning in March, the amount of rain steadily increases until the end of July. There is a marked diminution in August, so that the rainfall then is more like that of April. In September the rains return in full force, diminishing in November, and ceasing about December 1. I questioned a number

of persons in the llanos of Casanare quite closely about the weather, and their statements practically agreed with the foregoing. Moreno, once an important place, is now in ruins. It has hardly a hundred houses standing, and only two shops. There are a few "old families" here, and the one rich man had recently imported an upright piano from Hamburg. It was shipped *viâ* the Orinoco and the Meta to Trinidad, on the Pauta, thence overland on a rude cart to Pore, where it still is. Brito is a scattered village of twenty huts. Some of the adobe walls were of pink clay. A hot wind from the north-west became noticeable in Chire, and daily thereafter.

We spent a week in Pore, disposing of our oxen and making arrangements with a Syrian contractor to take our outfit on five good mules to the end of the railroad that runs north from Bogotá. On our arrival the annual fair of Pore was in full swing. The little town of sixty houses, some thatched and some tiled, was crowded to its utmost capacity. Ranch owners with stock, travelling merchants and pedlars with a very large supply of wine, beer, and liquor contributed to making things lively. The fair comes just at the end of the dry season. We received a royal welcome from the provincial alcalde, who was attending the fair. The Government telegraph wire reaches Pore *viâ* the Meta river, and President Reyes had sent messages which ensured us every consideration. On March 21, the morning after our arrival, it rained hard; "the first rain of the season" here. We seemed to have picked up the procession southward of the showers. After this we had showers nearly every day, but more commonly at night. During a heavy thunderstorm on March 27, at 2.30 p.m., the thermometer fell 12° in fifteen minutes (84° Fahr. to 72° Fahr.).

On our way from Pore to Nunchia we spent a night at Desecho, a famous ranch, where we experienced such comforts as French soap, Turkish towels, books, Bordeaux, various condiments, and excellently prepared food. We had had nothing like it for months, so it made a lasting impression. There are two ranges of hills between the llanos Nunchia. They differ from those north of the Panta, and seem to be of disintegrating lava instead of pebbles and boulders. The lava resembles that on Oahu, H. I. The altitude of the first range where we crossed it was 2700 feet above sea-level, or 100 feet above the plains. The view was superb. The llanos stretched away to the south and east as far as the eye, aided by powerful glasses, could reach. Great savannas alternated with the wooded flood-plains of numerous streams, the characteristic scenery of the upper llanos. The second range of hills is 300 feet higher than the first. Both run at right angles from the ridges that come from the main Cordillera. They are roughly indicated on Codazzis' large map, which we found very useful and more accurate than any of its successors. We spent a week in the provincial capital of Nunchia. It is a growing little town, with possibly one

hundred and fifty houses, many of them having roofs of corrugated iron. Our saddle mules had not been shod for two months, as we found no blacksmiths in the llanos. The cargo mules had also to be shod here.

The trail from Nunchia to Morcote is nothing but a wretched excuse for a bridle-path. I dismounted fifteen times to help my mule over the steep rocky stairway that passes for a road. We saw a number of orchids and orchid-gatherers in this vicinity. Morcote has a fine old church in fairly good repair. It is 203 feet long and 53 feet wide. Yet there are not more than fifteen thatched huts in the village, which is located on top of a rather steep ridge. The trail from Morcote to Paya lies through a dense tropical forest, such as one sees in Jamaica or Hawaii. At its highest point the road is 5000 feet above sea-level. Paya has between forty and fifty houses. Near by is a rough stone-wall fort built by the Spaniards. It is an eight-pointed star, only 120 feet in diameter, so that the story of its being defended by 500 Spaniards against the troops of Bolivar and Santander does not seem likely.

At Paya we turned north-west and began to ascend the valley of the Rio Paya. The mountains are very green and wooded to their tops. The valley is deep and has terraces. On these terraces are several villages, including Paya and Pisva. The latter is a wretched place of thirty thatched huts, occupied exclusively by Indians ("*Indios malos, ladrones*"). They make hats and sandals of fibre, which are sold to the burden bearers that use the paramo of Pisva. There are many bees in the vicinity, and some wax is manufactured. The women also spin yarn. There are three other villages in this valley that do not appear on the maps—Pancote with fourteen huts, a league above Pisva and on the other side of the valley, and Jota with a dozen huts a league farther on. At Tovacar there are eight or ten huts. This is the last collection of huts until one crosses the paramo and descends into the valley of Sogamoso. The huts are very small, rarely more than 8 by 10 feet, and have only one opening, closed by a raw-hide door stretched over a rough frame. The trail became so bad we employed four Indians to help the cargo mules, each mule requiring the constant attention of an Indian to help him from smashing his load to pieces in the rocky gorges. Occasionally the loads had to be taken off when the trail was too narrow to allow a loaded animal to pass. Had the alcalde of Pisva not sent several men the day before to repair the worst places in the trail, we should have found it quite impassable. It is small wonder that Bolivar lost all his animals and many of his men when he passed through here in 1819.

The paramo of Pisva has the usual characteristics of Andean passes. It is cold, damp, bleak, swept with a chilly fog from the north-east, a wilderness of small thorny plants, solitary ponds, coarse grasses, and almost no animal-life. It varies from 10,000 to 13,000 feet in height above the sea. We spent a wretched thirty hours negotiating its

slippery trails and resting from our efforts. During the night in the paramo the thermometer went to 31° Fahr. But the cold was intensely penetrating, and kept us from getting much sleep. Only one of the five saddle mules bought in Valencia succeeded in reaching the pleasant valleys beyond the paramo.

We reached Laguna Seca (Socha Nueva) on April 14. It is a tidy little town, high up on the side of the valley of the Sogamoso. The country hereabouts is very fertile and supports a large population. The houses are more often tiled than thatched, and small villages are very common. Wheat and sheep-raising appeared to be the chief occupations. An occasional water-power grist-mill added a picturesque quality to the scenery. The valley is very wide, possibly 3 or 4 miles, and a couple of thousand feet deep.

Socha, where Bolivar made his headquarters while recuperating from the passage of the Andes, is now a small town of no importance. Adobe walls and gates are very common throughout this part of Colombia. The towns have walled cemeteries, frequently circular in form, and often located conspicuously on the hill above the town.

Tasco is a thriving place, the present terminus of the telegraph service on the east side of the valley. We crossed the Sogamoso, in a gorge of great beauty, between Tasco and Corrales. It was very difficult to estimate the number of houses or inhabitants in this part of the journey, for the towns are so compact, land being greatly in demand for agricultural purposes. Furthermore, this region is not difficult of access and the official figures appear to be fairly correct.

We stayed at Duitama long enough to explore the interesting battlefield of Pantano de Vargas, where the British Legion covered itself with glory and saved the day for Bolivar, Santander, and Colombia. It was here that the gallant Colonel Rook lost his life. Duitama is famous for its fruit. In an orchard I saw peaches, apples, and oranges all doing well. From here to Bogotá is a cart road. Most of the way it is macadamized and well made. The other parts are in course of improvement. On this plateau the thermometer rarely rose above 60° Fahr. The plateau has the distinct appearance of having once been a chain of lakes. It is 9000 feet above the sea.

Near Paipa we visited some springs where the water appeared to be boiling hot. Our only remaining thermometer did not read above 115°, and burst in a vain effort to record the temperature of the springs. The water is heavily charged with sodium sulphate. A small plant, owned by a German, did a good business here, before the last revolution, supplying this necessary mineral to the bottle factory of the Bogotá brewery. The plant is now in ruins.

Passing through Paipa and Tunja, we stayed at the battlefield of the Bridge of Boyaca long enough to make a brief survey of it, and then pushed on through Chocontá and Hato Viejo to Nemocon. The railroad

was nearing completion (April 25), but regular trains were not running, so we went to Zipaquira, where we took the train for Bogotá, which we reached April 27, 1907.

The contrast between Venezuela and Colombia is very marked. The former country is still suffering from revolutions and bad government, while the latter, under the intelligent administration of General Reyes, seems to be making rapid strides forward. In regard to the difficulties of Bolivar's famous march, we came to the conclusion that the half had not been told.

DR. STEIN'S EXPEDITION IN CENTRAL ASIA.*

EARLY in December, 1907, I had reached from Turfan Karashahr, in the extreme north-east of the Tarim basin, and there I commenced my archæological explorations of the winter. Sites of ancient towns of some size could be traced at several points of the Great Plain, now mainly a waste covered with scrub and low jungle, which encircles the Bagrash lake on the north—witnesses of the importance which the territory of ancient Yen-k'i had possessed in pre-Mohammedan times. But the vicinity of sub-soil water, often impregnated with salts, and the effects of a climate evidently less dry than in other parts of the great Turkestan depression, had completely destroyed whatever structures might have once stood within the still extant clay ramparts. Chinese coins, picked up by me on the spot, made it possible to determine that these sites had been occupied down to the ninth century A.D. A far better field for systematic excavations was offered by an extensive collection of ruined Buddhist shrines, locally known as *Ming-oi* ("the thousand houses"), which occupies some low rock terraces at the easternmost foot of the range overlooking the Karashahr river from the south. Situated within easy reach of the high-road leading from Karashahr to Korla, the ruins had repeatedly been visited by European travellers, including Dr. Hedin, and within the last few years Prof. Grünwedel's archæological expedition, on its passage to and from Turfan, had effected excavations in some of the structures less buried under *debris*.

The disposition of the ruins in long rows of detached cellas, varying in size but all showing close resemblance in plan and construction, facilitated the employment of a large number of labourers. Thus, with relays of men easily obtained from the Korla oasis, the complete clearing of the ruins could be pushed on rapidly. Already the first diggings showed that, apart from the destructive effects of rain and snow, the temples had suffered much damage by a great conflagration which, in view of coin finds reaching down to the ninth century A.D., may safely

* Communication from Dr. Stein, dated Khotan, July 15, 1908.

be connected with the earliest Mohammedan invasions. But in spite of all the destruction caused by iconoclastic zeal and atmospheric influences, there remained plentiful archæological spoil. A great mass of excellent relievo sculptures in stucco once adorning the temple walls, emerged from the deep layers of *débris* filling the interior of the larger shrines; from vaulted passages enclosing some cellas we recovered fine fresco panels which a timely burial had saved both from fire and moisture. Finds of painted panels and delicately carved relievos in wood, once richly gilt, bore proof of lavish adornment with votive gifts which these shrines had once enjoyed. Considering the relatively late date down to which this sacred site had been occupied, the artistic excellence of many relievos, etc., was all the more striking. Notwithstanding some manifest differences of style, these sculptures and paintings yet displayed, quite as clearly as the art work of ancient Khotan, the predominant influence of Græco-Buddhist models from the extreme north-west of India. The manuscript remains recovered were either in Indian script or Uighur. Considering the great number of temples, the total absence of ruins which could with certainty be recognized as monastic dwellings, was a curious feature of this site. But if the living seemed to have been averse to taking up their abode with the gods, it was otherwise with the dead, for cinerary urns and boxes were unearthed in numbers around some of the shrines and stupas.

I could not trace in the vicinity any remains pointing to early occupation by villages. Yet the wide plain stretching eastwards, a desolate waste of scrub and sand, could even now be easily brought under irrigation by canals from the Karashahr river. Whatever changes desiccation may have effected in this region it seems certain that the supply of water now available in the Karashahr river far exceeds the needs of the narrow strips of land actually cultivated, chiefly by colonies of restless Tungans and semi-nomad Mongols, and that only the want of adequate population at present prevents a great extension of the cultivated area. I found, subsequently, similar conditions prevailing in the neighbouring oasis of Korla, where the population consists of industrious Turki-speaking Mohammedans.

During the weeks spent at Ming-oi we worked under quite Sarmatic conditions. Light snow fell almost daily, and the icy vapours sent forth by the great lake and marshes south rarely lifted above camp and ruins. So, after the completion of our tasks by Christmas, it was a relief to move up to the cold but sunny hills of Khora, two marches above Ming-oi, where information, elicited with much trouble from Korla shepherds and reticent Mongols, had led to the discovery of Buddhist ruins hitherto unnoticed. We found there a series of small temples and monastic dwellings built on rugged cliffs overlooking the wide stony valley of the Karashahr river, and curiously recalling by their position and character

those ancient Buddhist sanctuaries I had so often surveyed within and across the Indo-Afghan border. In spite of their secluded position, the shrines had not escaped iconoclast fury; but remains of fine wood-carvings and other relics recovered helped to illustrate the original richness of their decoration. Surveyor Rai Lal Sing had rejoined me at Ming-oi, after making his way from Turfan towards Korla, largely through previously unmapped portions of the Kuruk-tagh ranges. Further west these seem to be less barren than had been supposed so far, and to be regularly visited by Mongol herdsmen. Our visit to the Khora ruins gave Rai Lal Singh an opportunity for useful surveys on the range dividing the Karashahr valley from the open plain of the Tarim basin.

The new year found us at Korla, where, with the north-east end of the great sandy desert close by, I felt as if returned once more to my own ground. Stories of sand-buried towns in the desert haunt popular imagination in the northern oases almost as much as to the south of the Taklamakan; and the particularly definite form in which certain Korla hunters presented reports about large ruins seen by them in the narrow desert belt between the Charchak and Inchike river-beds induced me to test them here. The well-defined limits of the track indicated, and the absence of special difficulties about water-supply, made it possible to effect a thorough search of this hitherto unsurveyed area. This proved of distinct geographical interest by showing in typical form the changes brought about by shifting river-beds in the adjoining jungle belts, but revealed in the end, as sole real substratum for those reports, only remains of old Mohammedan tombs and of rude shepherd huts close to former river channels. Physical conditions make it appear very improbable that this area could ever within historical times have seen any large permanent settlement, as distinct from semi-nomadic herdsmen, such as are still to be found all along the Tarim and Shahyar rivers. But of course the negative result of our careful survey could make little impression on guides, imaginative yet *bonâ fide*, who with true Eastern reasoning would look upon the invisibility to our eyes of such imposing ruins as illusion fostered by traditional beliefs had shown them, merely as a proof of adverse magic prevailing against us!

From the Inchike (or Shahyar) river we marched over hitherto unsurveyed ground to Kuchar, Lal Sing following the course of that river right through to its debouchure from the mountains, while I myself struck across the broad belt of waterless desert to the north-west. The oasis of Kuchar, owing largely to its central position on the great northern trade route, had from an early period played an important part in the political and cultural history of the Tarim basin. Several extensive groups of ruined cave temples and other shrines, near where the oasis is bordered by the foothills, attest the flourishing condition of Buddhism during the centuries preceding conversion to Islam. But these ruins from which important finds of old manuscripts had reached

India since 1891, had in the course of the last five years been searched by successive parties of Japanese, German, and Russian archæologists and finally cleared with methodical thoroughness by the recent French mission under Prof. Polliot. So, after a week's halt, which was utilized for visits to these ruins and a rapid study of their specially instructive features, I was free by the close of January to resume my journey to the south of the desert.

Inquiries set on foot by me since leaving the Khotan and Keriya region in the autumn of 1906, had resulted in information reaching me about several ruined sites in the Taklamakan which had remained unexplored so far, and I was anxious to visit them before the heat and the season of sandstorms would make work on that ground impossible. A march due south through the desert to where the Keriya river dies away in the sands, certainly presented difficulties and possibly risks. But Dr. Hedin's pioneer journey of 1896 showed that it was practicable under certain conditions, and as there were ruins to be visited near the lowest course of the Keriya river, the hope of saving time by this "short cut" decided me to attempt it. The main difficulty was that while Dr. Hedin, coming from the south, had the line of the Tarim river at right angles before him as a broad and certain goal, our hope of reaching water within reasonable time from the opposite side depended on our steering correctly across some 130 miles of bare dunes towards a particular point and on the assumption that the Keriya river after an interval of twelve years still actually carried its dying course there. However much my reliance on Dr. Hedin's mapping was justified by previous experience, differences of longitude were bound to be considerable on such deceptive ground, and over the true sea of sand intervening there was nothing to guide us but the compass.

On January 29 we left the last shepherd huts in the Tarim jungle, and after a trying tramp of eight days, across high dunes, reached the northern edge of the dried-up delta, which the Keriya river had formed at some early period. There was nothing here to indicate the right channel in the maze of dry river-beds, all half buried by drift-sand, and often disappearing completely amidst jungle dead since long ages. Nowhere in the course of my desert travels had I met ground so confusing and dismal. So far, at a few places, we had been able to dig wells, and the scanty water they yielded had allowed us to husband our ice supply. This, and the severe cold still prevailing, assured safety of our relatively large party, though attempts to dig wells failed us again and again in this forbidding dead delta, and the river was not reached until six days' further march to the south. It had formed a new bed far away from the one which Dr. Hedin had followed, and the sands through which it now flowed were still absolutely sterile. It was a great relief when I at last sighted, from a huge ridge of sand, the glittering ice-sheet in the distance; for our camels had tasted no water for fully a fortnight,

and there was no small risk of the labourers I had brought from Shahyar, for the sake of eventual excavations, being tempted by their growing alarm into flight, and thus probably into destruction. It took several days more before we arrived at living forest, and found the river-bed branching off from the old one, close to the northern-most point I had reached on my journey of 1901.

The ground we had passed through had its own fascination, and survey work on it offered a good deal of geographical interest. Yet I was glad when, after a day's rest at a shepherds' camp by the Keriya Darya, I could resume archæological labours at the Kara-dong site which I had visited on my previous journey, and which the river, by its latest shifting, has approached—again after long centuries. In 1901 a succession of sandstorms had prevented a complete search of that site, and the shifting of dunes had since laid bare some ruined dwellings then too deeply buried beneath sand. The excavation of these now furnished definite antiquarian evidence that a small agricultural settlement had existed here far away in the desert during the early centuries of our era. Having been joined on the Keriya river by a party of my old "treasure-seeking" guides from Khotan, I marched with them by a new route to the desert edge north of the oasis of Domoko. There in the deceptive zone of scrubby jungle and high tamarisk-covered sand cones, they had succeeded in tracking a large but much-scattered series of ruins which had remained unknown to us during my previous explorations in this vicinity, and had escaped also Mr. Huntingdon's painstaking search in 1905. The remains, comprising, besides numerous dwellings, also several Buddhist shrines, resembled closely those I had excavated in 1900–01 at Dandan-oilik far away to the north, and proved to have been abandoned about the same period at the close of the eighth century A.D. In view of interesting geographical questions connected with physical changes in this region, it deserves to be noted that this site reaches within a few miles of the village of "old Domoko," which was abandoned to the desert some sixty years ago owing to difficulties about irrigation, but is now being slowly approached again by extending cultivation. This vicinity to an occupied area had, of course, resulted in much damage to the ruins. Yet in the end my excavations were rewarded by valuable finds in the shape of well-preserved manuscripts in Indian scripts, Buddhist paintings on wood, etc.

March and the early part of April were thus spent in archæological labours along the desert belt adjoining the oases from Domoko to Khotan. Amongst the ruins newly traced there, I must restrict myself to mentioning the remains of a large Buddhist temple, decorated with elaborate frescoes, now completely buried by high dunes in the desert strip between the Yurung-kash and Kara-kash rivers. Like the large Rawak Vehara which I discovered in 1901 in a closely corresponding

position not far from the opposite bank of the Yurung-kash, this temple proved to belong to the early centuries of our era. Unfortunately, subsoil moisture had weakened the walls to such an extent that continued excavation threatened to result in complete destruction.

After having been rejoined by Rai Lal Singh, who had in the mean time completed a detailed survey of previously unmapped ground in the north-west and north of the Khotan oasis, we set out by the desert route which leads towards Aksu along the Khotan river-bed, then practically dry throughout. It had long been my wish to look for ancient remains on the curious desert hill of Mazar-tagh which flanks the Khotan river on the west, some six marches below the oasis. My hope for archæological work here was fully justified by the discovery on that desolate ridge of the ruins of a fortified watch-station once guarding the river route. The fort had been destroyed by fire, but on the steep rock slope below, big masses of refuse thrown out by its occupants in the course of long years had fortunately remained in excellent preservation, safe from moisture and driving sand. From this unsavoury quarry we recovered a great collection of documents on wood and paper, in a variety of scripts, mainly Indian, Chinese, and Tibetan, and none apparently later than the eighth and ninth century A.D. The great mass of these records evidently belongs to the period of Tibetan invasions, and closely corresponds in appearance and character to the records brought to light by me last year from the ruined fort of Miran south of Lop-nor.

A reconnaissance pushed north-westwards showed that the Mazar-tagh is not an isolated hill, but indeed a low range stretching far away into the desert, as assumed by Prjevalsky and Carey who first saw it. In the absence of actual survey the fact had since been doubted. Direction and geological structure alike point to its being a continuation of the ancient chain of which portions survive further to the north-west about Maralbashi.

By the beginning of May we reached Aksu, having suffered a good deal *en route* from the heat of the desert and sandstorms. At Aksu I was able to arrange, through the help of my old mandarin friend, Pan-Darin, now Taotai, for the local help which Rai Lal Singh needed for the continuous survey he was to carry along the outer Tien-shan range westwards as far as the passes above Kashgar. I myself travelled up the Uch-Turfan valley, and thence marched by a route not shown by published maps across a barren but remarkably picturesque mountain range to the oasis of Kelpin. In spite of peaks rising from 12,000 to 13,000 feet, water is now very scanty throughout these mountains.

The way in which obvious desiccation has affected the conditions of Kirghiz herdsmen grazing in the valleys, and the survival among them of local lore unmistakably of pre-Mohammedan origin, offered interesting objects of study. Information opportunely secured through "treasure-seekers" of Kelpin led to the discovery of extensive *débris* areas, marking

ancient settlements in the desert belt between the arid outer hills of Kelpin and the lowest course of the Kashgar river. Far-advanced erosion had left little or no remains for excavation, but enough archæological evidence was secured to prove that this tract, once traversed by the ancient Chinese high-road to Kashgar, had been occupied down to the eighth century A.D. by large settlements to which canals still traceable in parts carried water from the Kashgar river. There was opportunity here also for interesting topographical work, as my survey revealed a series of low parallel ranges, which continue to the north-west the line of the curious rugged hills about Tumshuk and Maralbashi shown by extant maps as isolated rock islands.

The proper season for work on such arid desert ground had long passed when regard for the tasks awaiting me at Khotan obliged me, towards the end of May, to stop my explorations about Maralbashi. A rapid journey *viâ* Yarkand brought me by the middle of June back here to Khotan. The arrangement and packing of my archæological collections, accumulated during two years' labours, are bound to prove an exalting task, seeing how extensive they are and how much care is needed to prevent damage to often fragile antiques on the long and difficult transit to India. Thus I am likely to be kept hard at work in Khotan until the close of July. Since my arrival I have had the great grief of seeing Naik Ram Singh, of the 1st (Bengal) Sappers and Miners, who had accompanied me from the commencement of this journey, and had rendered very useful assistance about photographic work, plans of buildings, and other tasks needing a "handy man," return from a journey to Charlik, on which he had started for a supplementary task towards the close of March, with complete loss of eyesight. He had left me in what seemed fair health, and without any sign of approaching eye-disease. The misfortune of the poor sufferer, who has been sent with all needful care to Yarkand for medical treatment, causes me greatest concern.

After completing my tasks at Khotan, I hope to carry out, with Bai Lal Singh, explorations in those parts of the high Kunlun range about the Yurung-kash and Kara-kash sources which still remain to be surveyed. Then, late in September, we may be able to start on the return journey to India over the passes of the Karakorum.

VICINITY OF LAKE TE ANAU AND MILFORD SOUND, NEW ZEALAND.

By Prof. R. MARSHALL, D.Sc., F.G.S.

THE presence of seals and whales in the fiords and off the south-west coast of New Zealand in the early years of this century, was the cause of the exploration of the coast-line long before anything definite was

known of the richer, and at the present time vastly more important, eastern agricultural districts of the dominion. The numbers of seals soon diminished in consequence of the reckless slaughter, and the whales were more conveniently tried out at Stewart island and on the southern coast of the mainland. As a result, the western coast was almost deserted even by these casual visitors long before the middle of the century.

It was accurately surveyed, and the fiords were partially sounded by the *Acheron* in 1857, but no settlement followed, and even at the present day the deep and secure inlets are almost uninhabited.

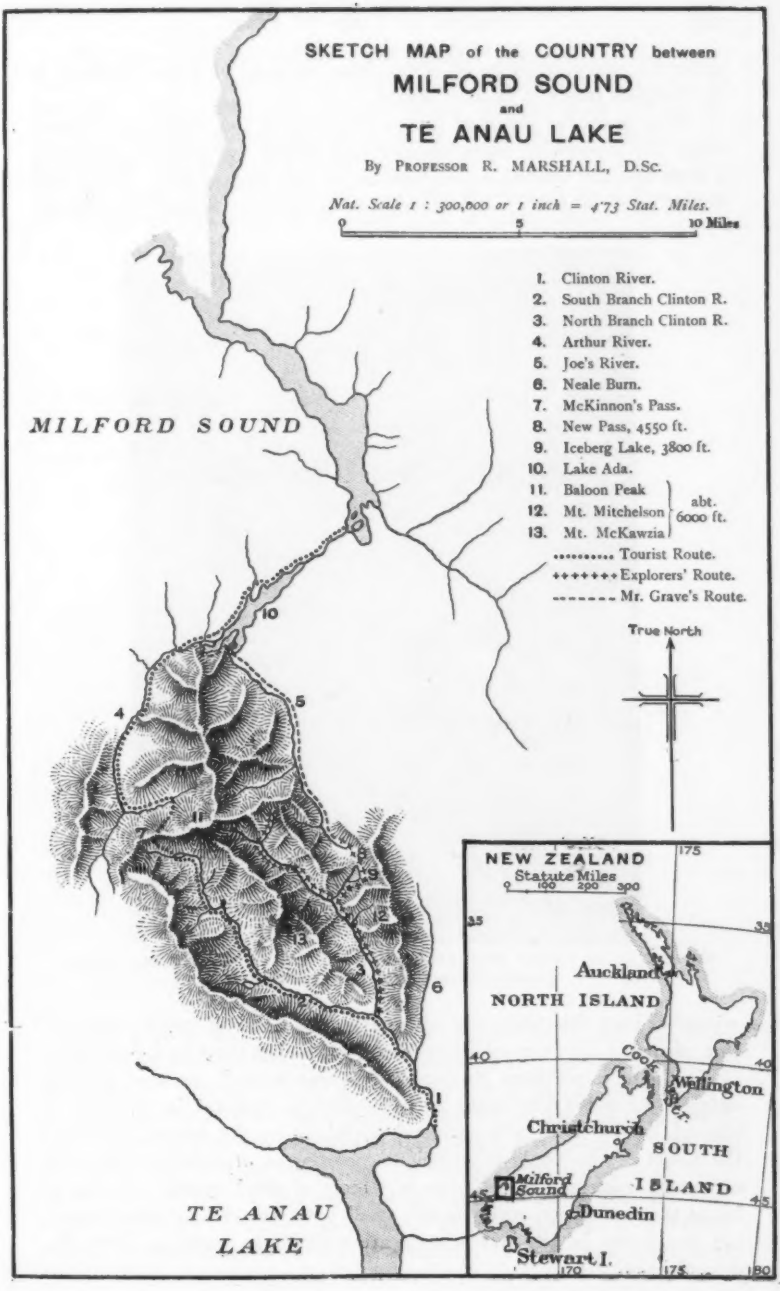
There is a lighthouse at Puysegur point, saw-milling and fishing stations at Preservation and Chalky inlets. At Dusky sound there is a Government resident in charge of the sanctuary for native birds at Resolution island, and at the head of Milford sound there is an accommodation house for tourists who walk over the Mackinnon pass from Lake Te Anau. Elsewhere this wild and storm-beaten coast with its far-reaching fiords enclosed by beetling precipices, with its dense forests of evergreen beech, with its mountain peaks streaked with glaciers, is still as unaffected by the colonization of the land as in the days of Captain Cook.

Some 40 miles to the eastward there is a nearly continuous line of lakes—Te Anau, Manipouri, Monowai, Poteritari. From the lakes fiords penetrate westward into the rugged mountainous country, as do the marine inlets on the seaward side. On the eastern shore of the lakes the country changes. The shores are less abrupt. Bush is replaced by grass-lands. The plutonic rocks give place to soft Tertiary sediments, through which rise ranges of folded Mesozoic slates.

The contrast in climate is as great as that in vegetation and topography, for all over the region to the west of the lakes the rainfall is between 150 and 250 inches per annum, while to the eastward it diminishes to 40 inches.

This area between the lakes and the Tasman sea is a physiographic unit. Throughout its area its features are similar though widely different from those of the country to the east. It is true that characteristics not widely divergent in climatic and vegetational and mountainous features are continued into the country to the north, but when the Darvan mountains (north-east of Milford sound) are passed, the nature of the rock changes, the valleys are less abrupt, the fiords end, and the line of lakes is more interrupted and retreats further eastward.

The coast-line has been described as desolate and uninhabited, but these words are still more descriptive of the interior portions, for there are no inhabitants with the exception of a few guides, who, during five summer months, occupy the accommodation houses that have been erected by the Government for the shelter of those tourists who


SKETCH MAP of the COUNTRY between
MILFORD SOUND
and
TE ANAU LAKE
By PROFESSOR R. MARSHALL, D.Sc.
Nat. Scale 1 : 300,000 or 1 inch = 4·73 Stat. Miles.
0 5 10 Miles
1. Clinton River.
2. South Branch Clinton R.
3. North Branch Clinton R.
4. Arthur River.
5. Joe's River.
6. Neale Burn.
7. McKinnon's Pass.
8. New Pass, 4550 ft.
9. Iceberg Lake, 3800 ft.
10. Lake Ada.
11. Baloon Peak
12. Mt. Mitchelson
13. Mt. McKawzia
abt. 6000 ft.
Tourist Route.
Explorers' Route.
Mr. Grave's Route.
True North
MILFORD SOUND
TE ANAU LAKE
NEW ZEALAND
Statute Miles
0 100 200 300
Auckland
NORTH ISLAND
Cook Str.
Wellington
Christchurch
SOUTH ISLAND
Milford Sound
Dunedin
Stewart I.
35
40
45
170
175
180

undertake the journey of 35 miles from the head of Lake Te Anau to the furthest recess of Milford sound.

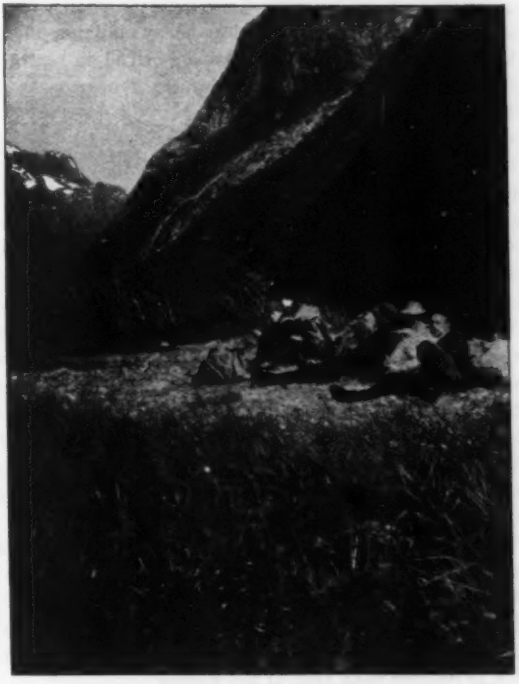
Even more, for much of this country which lies within 50 miles of large and productive sheep stations and within 200 miles of Dumed—a town of sixty thousand inhabitants—is still unexplored. Nor is this due to want of energy and enterprise on the part of the colonists, for

NORTH CLINTON VALLEY FROM NEAR ITS HEAD, 2000 FEET ABOVE SEA-LEVEL. AVALANCHE TARNS IN MIDDLE DISTANCE.

wherever land that offers any advantages that allow of possible occupation occurs, it has been seized upon and utilized to the best advantage.

In the more northern portions of the wet zone of the west, mining enterprise has led Europeans to make their homes, but in this area of plutonic rocks there is no mineral contained in the stream sands at the heads of the fiords in sufficient quantity or of sufficient value to encourage miners. The timber is seldom of good enough quality to tempt the saw miller, while on the small plots the difficulties of clearing the forest in the wet climate are sufficiently great to deter the agriculturist.

This area of 10,000 square miles remains practically unoccupied. It has lately been proclaimed a Government reserve, so the beauties of forest and stream, of mountains and valley, of calm fiord and storm-beaten coast will remain here untarnished. The future colonist will from these forests be able to actually view the trees that at one time covered a large portion of the land, and see the strange birds that gave such interest to the wilds in the early years of colonization.



SUMMIT OF AVALANCHE TALUS SLOPE.

From time to time expeditions have crossed this forest land from lake to ocean, and little by little our knowledge of it increases. Tracks have been cut through the bush and over a few of the lowest passes by the Government, but the rapid growth of the vegetation, the destructive force of the spring avalanches and the flooded streams make constant work necessary in order that these tracks should be kept in a fit state for ordinary travellers. At the present time, the track from the head of Lake Te Anau to Milford sound is the only one that can be traversed without encountering considerable difficulty. The natural features of

this route have been lately described by Mr. Andrews, of Melbourne, in the *Journal for Geology*. For colouring of stream, rock, and forest, for magnificence of mountain and glacier, for grandeur of waterfall and precipice this route is unsurpassed in accessible districts of New Zealand.

Hitherto the route followed—only 35 miles in length—has been the only known route to Milford sound. Elsewhere the precipitous rock-walls, everywhere over 2000 feet in height, have been supposed to present an insuperable barrier. So far as the regions to the south are concerned, this appears to be correct, as has been shown by Mr. W. G. Grave, who for three consecutive summers has made attempts to traverse the mountain barriers. His journeys are described in some detail in a paper that will shortly be published in the *Transactions of the New Zealand Institute*.

To the north an attempt was made by Mr. W. Quill, who apparently attempted a pass from the head of the Cleddan to the head of the Hollyford, but lost his life in the endeavour.

It was with the object of adding to our very limited knowledge of this interesting district that a party was organized in January, 1906. It consisted of six men engaged in various branches of education in New Zealand—Dr. Marshall, Messrs. W. G. Grove, A. E. Flower, A. G. Grenfell, R. Browne, G. Talbot. All were qualified by previous exploration experience in this type of country. In estimating the comparatively small result achieved, it must be remembered that all food supplies have to be carried, for there are no indigenous vegetable products of an edible nature. The few native birds are jealously protected from harm by law regulations, and it was our wish to abstain from any action that might increase the rate at which their numbers are gradually decreasing even in this out-of-the-way district. The dense bush entirely prevents the use of transport animals, and financial considerations prevented the employment of packers. For these reasons it was necessary to carry goods of 60 lbs. each, which included twenty-one days' food. Even in summer the weather is liable to be cold enough, for sleet showers and heavy rain is certain to be experienced, for in this region the summer precipitation is heavier than that of the winter.

The rough nature of the ground, the heavy bush consisting of trees matted together with dense undergrowth and interlacing climbers, rendered progress with the heavy swags extremely slow. The undergrowth is constantly saturated, the ground is often swampy, and from time to time the foaming rapids of the stream offer the only available path. An explorer is saturated throughout the day. At night the waterproof sleeping-bag keeps him dry, but the wet clothes have to be put on again for the morning's start.

The actual ground selected for the expedition was the north branch of the Clinton river. The south branch is followed by the present track. It was hoped that a pass might be found that would lead into

the drainage basin of Milford sound or into the basin of the Hollyford, from which Lake Wakatipu could be reached.

The progress of the expedition was slow, for with the most strenuous exertion half a mile per hour was the fastest rate of travelling, and it was seldom that a greater distance than 3½ to 4 miles was attained in a day's journey.

The valley was found to have an estimated length of 14 miles. At

HANGING VALLEY ON ROUTE LEADING TO PASS 1070 FEET HIGH.

its entrance its floor is 750 feet above sea-level. Throughout it is bounded by precipitous walls of plutonic rock, diorite, and gneiss, attaining almost everywhere a height of 2000 feet. From the summit of these walls the mountain peaks rise to a further height of 4000 feet. The peaks themselves are often precipitous, but as a rule the slopes near the valley bottom are steeper than those at higher levels. The floor of the valley is often flat, but frequently it is strewn with masses of irregular boulders of gigantic size. Upon and among them grows the most luxuriant vegetation, and the whole forms a complex that is

well-nigh impenetrable. In some cases these blocks represent old rock-slides, but more frequently they are old morainic masses left behind when there was some temporary halt in the retreating glacier that once filled the valley. In many cases the rock-walls rise vertically from the flat floor without any intermediate slope of talus, but after the annually recurring avalanches of spring bring down masses of *débris* that form small cones extending some hundred yards into the valley, which is usually about 500 yards wide. Wherever hedges give a foothold, clumps of trees have established themselves, and such patches occur at intervals almost to the top of the rock-walls. In many places the growth of vegetation is prevented by the annually recurring avalanches, which bring down snow in such volume that masses of it still remained at an elevation of 900 feet at the end of January.

Several of these avalanche slopes ended in tarns 100 yards or more in diameter, and since I can find no description of such features as these "avalanche tarns" elsewhere, a brief explanation of their formation may perhaps be admitted.

The first avalanche of spring is composed of the outer layers of snow only, which carries no *débris*, but forms a large wide-spreading cone at the foot of the slope. The avalanches that fall later on are composed of snow, that was actually in contact with the rocky face. They carry down huge masses of *débris* that roll down the slope of the previous cone, and accumulate round its margin. As the summer advances, the avalanche cones of snow melt, and the marginal *débris* encloses a basin more or less circular, within which the waters of the tarn are enclosed. Usually a waterfall courses down the rocky face and tumbles into the tarn, so these features add beauty as well as interest to the sights of the valley.

The flat floor rose slowly and uniformly, and finally terminated in a well-defined cirque at 3500 feet above sea-level, 14 miles from the valley entrance. The floor of the cirque was partly covered with snow, and the mountain-slopes above were also snow-clad. The bush, which in the lower part of the valley was chiefly "birch" (*Notogogus menziesia*), changed to "ribbon-wood" (*Plagianthus lyalli*), and, in places where the water hung and swamps were formed, grasses and sedges replaced the bush. Everywhere on the avalanche cones, which are found abundantly on the sides of the valley, representatives of the Alpine flora were flowering freely. The white-flowered *Ranunculus Celinisias* in many species, Angelica, Craspedia and many other genera, added their quota to the general effect.

The walls of the cirque rose very steeply to a height of 3000 feet above the floor, and it was found impossible to scale them, and all idea of climbing over to the western slope from the head of the valley was abandoned, and we were forced to retrace our steps. At the only bend in the valley 2 miles from the cirque a view of the northern face of

Balloon peak was obtained. The peak appeared as abrupt from this point of view as it does from the south, where its dominating mass always excites the interest and wonder of those who travel over the McKinnon pass from Te Anau to Milford.

A snow-storm soon concealed the peak, and through the sleet and rain we returned to a point 5 miles distant from the lower end of the valley. Here a stream enters the north branch of the Clinton over a hanging valley, and the slope of the bounding wall being here less severe, offered a chance of reaching the ridge that bounded it.

CIRQUE AT HEAD OF NORTH CLINTON VALLEY.

The ascent was commenced on a brisk south-west day when patches of blue were appearing in the sky, that for more than a week had been covered with a grey pall. The slope up the cascade proved 1050 feet in height and extremely steep, but at this height a valley $1\frac{1}{2}$ mile long with a bottom almost flat was reached. At its end was a waterfall 540 feet in height, but the mountain scrub growing by its side enabled us to climb to the top. The stream flowed out of a lake three-quarters of a mile long and half a mile wide. It was bounded by high mountains

on the south, north-west, and north-east, but to the east and north the walls rose to only 600 feet above the water. The dip to the east proved to lead over the Neale burn, another tributary of the Clinton, but the dip to the north proved to be a practicable pass of 4600 feet altitude to the western slope. At the northern foot of the pass a stream flowed eastward, but when afterwards followed by Mr. Grove it was found to turn to the north, and was finally identified as Joe's river—a stream whose outlet into Lake Ada, near Milford sound, is well known.

The lake on the summit, Iceberg lake, is a perfect example of a rock-basin. Except to the north, where there is a flat a few square yards in extent, the mountain-sides dip straight into its water without any change of slope, and its outlet passes over a lip of solid rock.

Throughout this description it will have been noticed that the features of the main valley are those usually considered as characteristic of valleys formed by glacial erosion. The typical U shape—with steep sides and flat bottom—the lateral hanging valleys, the terminal cirque, the absence of over-lapping space, all point to this conclusion. The U shape of the hanging valley itself and its rock-basin lake from which it was fed are confirmatory of this conclusion.

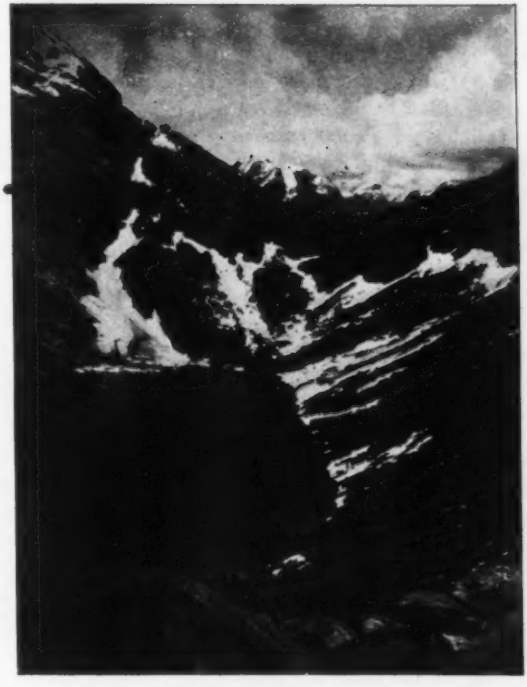
The features of this valley, as described above, are common to the many hundreds of valleys of this grand country; but in most instances there is less simplicity. In the Route burn, the Greenstone, and the Clinton, when the main stream is joined by large tributaries nearly equal to it in size, they enter at grade, and there is usually a sharp descent in the main stream immediately above the junction. Many of the streams that flow in hanging valleys issue from rock-basins, as Lake Harris in the Route-burn valley, Lake Quill in the Arthur, to quote two out of numerous examples.

There can be no doubt in the mind of any one who knows this country that the very similar—almost identical—features extending over the whole country from Preservation inlet to Milford sound, and even further north, are due to the action of the same general cause. The great contrast between the forms of mountain and valley found here and those found in the elevated region of the North island, prove that—even after allowing for the difference in rock structure—different agents must have sculptured the country in the two areas.

The frequent presence of glaciated rocks in the fiords; of huge moraines to the east of the lakes; the great depths of the fiords, 1500 feet; of the lakes, 1600 feet; and of other glaciated valleys, prove that the whole area has been traversed by huge glaciers.

Steep as are the sides of the valleys, straight as is their alignment, their uniform depth and width, the different directions of different valleys, and their abrupt cirque terminations, prevent one from describing them as infallen areas, trough faults, or graben. There is no evidence, so far as my observation of the country is concerned, in favour

of beheading and intercepting of streams, as described by Garwood, to account for hanging valleys in the Himalayas.* There is no change in rock structure to account for rock-basins, as described in Canton Ticino.† The flat bottoms of the valleys, varied only by sudden steps, the comparative absence of alluvium except at the outlet, combine to render any explanation, based on the erosive action of running water, inapplicable.



ICEBERG LAKE, SHOWING WESTERN RANGES OVER THE PASS.

For these reasons the author believes that in this region, at any rate, the peculiar features of the valleys are due to the flow of ice-streams along them. The directions of the valleys were in all probability, in the first place, due to ordinary stream erosion before the colder climate of the Pleistocene allowed of the accumulation of snow and ice in sufficient quantity to form the glaciers that afterwards developed valley, lake, and fiord basins.

* *Q.J.G.S.*, vol. 58, p. 703.
† Garwood, *Q.J.G.S.*, vol. 62, p. 165.

THE NINTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

By GEO. G. CHISHOLM.

THIS Congress met at Geneva and held its sittings from July 27 to August 6, under the presidency of Dr. Arthur de Claparède, President of the Society of Geography of Geneva, Honorary Corresponding Member of the Royal Geographical Society of London, etc. It was attended by 740 members and associates, an exceptionally large number, a fact no doubt largely due to the convenient geographical situation combined with the natural attractions of the place of meeting.

Honour was done to the Congress both by the federal authorities of Switzerland and the cantonal authorities of Geneva. At the opening meeting two ushers in uniform, one federal and the other cantonal, stood at the foot of the presidential chair, which was occupied by Dr. Ernest Brenner, President of the Swiss Confederation, and one of the honorary presidents of the Congress, who opened the proceedings with an address of welcome. In this address he bore testimony to the growing interest in geography manifested in Switzerland since the (Fifth) International Congress met in the capital of the country in 1891, and declared that it was the unquestionable merit of that congress to have contributed to the transformation of geographical education which has since taken place in the schools of Switzerland. In connection with this, he also drew attention with just pride to the great outlay made both by the Confederation and the cantons in the interest of geographical education in the primary and secondary schools, and mentioned that the association of the heads of departments of public instruction in the Swiss cantons was now engaged, with the support of the Confederation, in the preparation of an atlas for use in the secondary schools, which was to be followed by another designed for the primary schools.

Dr. Brenner was followed by Dr. A. de Claparède, who, after expressing his thanks to the federal and cantonal authorities for the reception given to the Congress, gave a brief review of the previous congresses. Acknowledgments from Captain Cagni, delegate of the Italian Government, as representing the state delegations, Prof. Gerland (Strassburg), as representing the University delegates, Prince Roland Bonaparte, as delegate of the pioneer geographical society, that of Paris, representing all the geographical societies, and from Prof. Davis (Harvard), as representative of other organizations, closed the meeting.

The Congress then at once proceeded to business. Two hundred and thirty-five papers were offered to and accepted by the organizers of the Congress, but a considerable number of them were not read owing to the absence of the writers or any authorized representatives of the writers of the papers, and few abstracts were available of those which were read. The number actually read, however, was very large. The papers were distributed among fourteen sections, surely an excessive subdivision, viz.

(1) Mathematical Geography and Cartography (Pres., Lieut.-Colonel Held, Bern); (2) General Physical Geography (Pres., Prof. Penck, Berlin); (3) Vulcanology and Seismology (Pres., Dr. Johnston-Lavis, Naples); (4) Glaciers (Pres., Prof. Brunhes, Freiburg); (5) Hydrography—Potamography and Limnology (Pres., Prof. Forel, Lausanne); (6) Oceanography (presided over by Prof. Krümmel, Kiel, in the absence of Sir John Murray, Edinburgh); (7) Meteorology and Climatology along with Terrestrial Magnetism (Pres., Prof. Hellmann, Berlin); (8) Biological Geography (Pres., Prof. Casimir de Candolle, Geneva); (9) Anthropology and Ethnography (presided over by Prof. Lenz, Prague, in the absence of Prof. Hamy, Paris); (10) Economic and Social Geography (Pres., Prof. Eug. Oberhummer, Vienna); (11) Exploration (Pres., Prof. O. Nordenskiöld, Gothenburg); (12) Geographical Education (Pres., Prof. Davis, Harvard); (13) Historical Geography (Pres., Prof. Cordier, Paris); and (14) Rules and Nomenclature (Pres., Commander Roncagli, Rome).

The sections were all conveniently and comfortably accommodated in the rooms of the University and the Athénée, and as a result of the excessive subdivision of sections, in order to reduce so far as possible the difficulty of enabling the members to be present at the reading of all the papers in which they are interested, the sections did not all meet on the same days. Alternate days were devoted to the meetings of the odd-numbered and even-numbered sections. Further, the meetings of the sections were confined to about two hours in the afternoons, and certain papers, considered to be of more general interest, were selected for reading in the mornings in the Aula or great hall of the University, where the opening meeting of the Congress was held.

The first paper so read was that of M. Alex. Moret, joint conservator of the Musée Guimet, Paris, on the confirmatory evidence in support of the account of the Periplus of Africa under Pharaoh Necho II., as given by Herodotus, afforded by the recent discovery of two scarabs with hieroglyphic inscriptions, recording, in one case, the return of the navigator who accomplished the voyage, and, in the other, the whole course of the voyage. The communication was received by the audience with much interest, but not without expressions of reserve on the part of some of them.

The morning sitting of the second day of the Congress was taken up with another paper which excited very general interest—that of M. W. Rosier, Councillor of State, and President of the Department of Public Instruction, canton of Geneva, on the "Proper Domain of Geography as a Branch of Education." The reader of the paper contended that, regarded from that point of view, geography has for its object "the reading of maps and the scientific description of the Earth; that is, of the various constituents, animate and inanimate (*des éléments divers, physiques et vivants*), the combination and interconnection of

which determine the actual physiognomy of the globe; that it is divided into mathematical, physical, biological, and human geography, this last being again subdivided into historical, political, and economic geography." At a meeting of the education section on the afternoon of Monday, August 2, this account of the function of geography as a branch of education was brought forward by M. Rosier as a definition proposed for adoption by the Congress, and, as such, was the subject of an interesting and animated debate, in which Profs. Ricchieri, Davis, Telles, Vidal de la Blache, Chodat (rector of the University of Geneva), and others took part. From various points of view, the proposal of M. Rosier was subjected to criticism, and no satisfactory conclusion was arrived at. It should here be mentioned, however, that at the original reading of M. Rosier's paper in the Aula, an excellent wall-map of Switzerland for school purposes was exhibited, and much applause (and no doubt secret envy) was aroused when it was mentioned that this map was distributed gratis by the federal authorities to all the schools in the Confederation.

M. Rosier was followed at the morning sitting in the Aula on the second day of the Congress by Prof. Flahault, Director of the Botanical Institute, Montpellier, who, in an extremely eloquent address, dwelt on the practical importance of the study of botanical geography as a means of increasing the available resources of the Earth, and strongly urged on his hearers the duty of taking every opportunity of conveying to those who were in a position to use such knowledge any information of that kind of which they were possessed. Prof. Oberhummer of Vienna then gave an able lecture on Leonardo da Vinci and the Art of the Renaissance in their relation to geography.*

The third day in the Aula was devoted to the consideration of glacial theories. The first paper was that of Prof. Penck, based on observations made by him, indicating the lower limit of perpetual snow in the Alps during the glacial epoch. His observations showed, he contended, that the glacial *névés* did not ascend much above their present level, and that it was only the lower part of the glaciers which extended far beyond the limits of the present epoch, and this could be attributed, therefore, only to a lowering of temperature (not, indeed, very great in amount) during the glacial epoch, not to an increase in the quantity of snow precipitated. Corroborative facts in support of Prof. Penck's views were mentioned by Profs. Chodat and Martonne (Lyons); and Prof. Forel, having mentioned that his studies on the glaciers of the present day had revealed an extraordinary parallelism between glacial phenomena and the thermal variations of the three summer months, maintained that the further prosecution of such researches might afford a very valuable aid to the study of the glacial epoch.

* To be published in the *Geographical Journal*.

Prof. Penck's paper was followed by one by Prof. Brunhes (Freiburg, Switzerland) on the mode of glacial erosion. Illustrating his subject by numerous lantern-slides, he emphasized the distinction between U-shaped glacial beds and V-shaped torrent-beds, and insisted that a glacier was to be regarded, not merely as a mass of ice, but as composed of ice and water, and that the erosive action of the glacier water, as modified by the presence of the ice, was at least as important as that of the ice itself.

On the fourth day of the Congress, Thursday, July 31, no meetings were held, but on the day following the proceedings in the Aula were in various ways important. Precedence was given to the expression of congratulations to the Geographical Society of Geneva on reaching the fiftieth anniversary of its foundation, the occasion of the invitation being addressed to the Congress by the city of Geneva. Letters of congratulation were read from the King of Roumania and the King of the Belgians, and then Prof. Oberhummer presented to the Genevan Society a copy of the magnificent volume of historical maps which had been prepared by the Imp. Royal Geographical Society of Vienna, on the occasion of its completing the fiftieth year of its existence, in the previous year. Several communications relating to polar exploration followed. Commander Cagni, the explorer who has approached nearest the north pole in the Old World, read a letter from Prof. Peary. Mr. J. P. Tolmachef, Conservator of the Geological Museum of the Academy of Sciences, St. Petersburg, then made a report on a projected expedition, to start in 1910, for the exploration of the Taimur peninsula and Cape Chelyuskin, a region of which there was no exact topographical record, owing to the destruction by fire of the documents derived from the first survey. Afterwards M. G. Lecointe, Director of the Observatory of Uccle, Belgium, gave an account of the International Polar Commission, founded at Mons in 1905; and at the conclusion of this paper, the meeting adopted the following resolution, several delegates refraining from voting: "That the Ninth International Congress, held at Geneva in 1908, expresses the hope that the Governments interested will consider with the utmost good-will the request which will be addressed to them by the provisional bureau of the International Polar Committee to give their support to that committee."

The sixth day in the Aula was mainly devoted to the Antarctic regions. Prof. Otto Nordenskiöld, with the aid of splendid lantern slides and excellent maps, gave an account to a most enthusiastic audience of the Swedish expedition to those regions, and indicated the main conclusions to be derived from the observations made in the course of the expedition. Afterwards M. Henryk Arctowski gave a brief review of Antarctic problems presented for solution as the result of the various Antarctic expeditions made to the present date. The sitting concluded with an exhibition by Prof. Gaetano Platania, of Acireale, of cinematographic representations of an eruption of Stromboli.

On Monday, August 3, Herr Filchner, an officer in the German army, gave an account of his explorations, during which he was accompanied by his wife, in eastern Tibet, in the upper part of the basin of the Hwang-ho. On Wednesday, August 5, two interesting papers were read at the last general meeting held by the Congress for such business. One of these was a paper on "Free Ports," by Prof. Blondel, member of the Society of Commercial Geography of Paris, who, after giving a sketch of the *rôle* played by free ports in history, went on to consider the function of their modern representatives, the zones in certain ports exempt from customs duties, and concluded by indicating the losses which France incurred from her exaggerated protectionist policy leading her to refuse to recognize the free port even in this form. The other paper was by Prof. Eug. Oberhummer, on the geography of great towns, a subject which, the author contended, was of interest in Europe only since the Renaissance, inasmuch as before that time even the largest towns of Europe were quite small as compared with those of China. In a brilliant address, which, it is to be hoped, will soon be available for perusal in full, Prof. Oberhummer set forth the great variety of considerations that have to be taken into account in dealing with this subject.

On August 4, M. de Lallemand, Engineer-in-Chief of Mines, Paris, read a paper, which excited a great amount of interest, on the periodic movements of the Earth's crust analogous to the tides. These movements were ascertained by the deviation in the oscillations of the pendulum from the rate calculated for an assumed perfectly rigid earth; but the deviation was so small as to baffle all efforts to determine it, until at last the difficulties were overcome by Prof. Eckert at the Geodetic Institute at Potsdam. This paper was followed by a communication from Dr. Léon W. Collet, privat-docent, Geneva, on the investigations of the Scottish lakes made under the direction of Sir John Murray.

From the numerous papers read at the sectional meetings, it is difficult to make a selection that can be considered as fairly representative in the limited space that can be afforded in the pages of the *Journal*, but it must be understood that many papers of interest were read besides those here referred to.

In Section I. (Mathematical Geography) the papers read included the following: "The Survey of Egypt," by Captain H. G. Lyons, F.R.S., Director-General of the Survey of Egypt; an account of the results of the levelling operations in France from 1899 to 1908, by Mr. Ch. Lallemand, Paris, the director of the operations; a statement of the results of railway levellings in European Russia employed as a hypsometrical base, by General Schokalsky; an account of the operations in connection with the delimitation of the Anglo-French frontier north and south of the Gambia, by Mr. A. B. B. de Tscharner;

"Artistic Work in Cartography," by Colonel F. Becker of the État Major, Zürich, a paper which excited some discussion in which Colonel Held, Profs. Wagner, Oberhummer, and others took part. The paper by Captain Lyons on the "Survey of Egypt" was divided into two sections, the first giving an account of the present state of the survey and the maps which have been produced, and the second describing the peculiar conditions under which the survey was carried out. The author stated that "within the last ten years a complete series of cadastral maps on the scale of 1 : 4000 or 1 : 2500 have been published for the whole of the cultivated lands of Egypt, and by the end of the present year a series of maps on the scale of 1 : 50,000 for the same area will have been completed, and considerable progress has been made with a series of maps on the scale of 1 : 10,000." The triangulation in the Nile valley has been made the starting-point for other triangulations in certain parts of the desert area, as, for example, one just begun along the Mediterranean coast west of Alexandria, and one already effected in the eastern desert between 22° and 26° N., with a view to the accurate determination of mining claims and concessions.

Among the papers read in Section II. (Physical Geography) were one by Dr. J. van Baren (Wageningen) on the "Morphological Structure of the Diluvium north of the Rhine in the Netherlands;" one by Mr. J. J. Sederholm (Helsingfors) on the "Geomorphology of Finland;" one by Prof. Martonne (Lyons) on the "Systematic Position of the Chain of the Carpathians;" and one by Prof. W. M. Davis expounding a series of illustrations devised by him for teaching purposes to assist the student in realizing the nature of certain geomorphological processes. Those shown were only a few selected examples, and similar illustrations, the lecturer stated, were used by him in connection with meteorology and other branches of geographical teaching.

Section III. (Vulcanology and Seismology) was opened the first day by a paper by the President, Dr. Johnston-Lavis, on the "Mechanism of Volcanic Activity," which gave rise to a discussion in which Profs. Velain (Paris), Hobbs (Michigan), and others took part. Among other papers read in the section were: "The Relations between Tectonic and Seismic Conditions in Western Asia," by Prof. Rudolph (Strassburg); "Great Oceanic Depths considered from a Seismical Point of View," by the same author; "A Comparison between the Two Great Oceans as regards their Liability to Earthquakes," by Prof. Gerland (Strassburg); "A Review of Volcanic Theories," by Prof. Ch. Velain, based on his own labours, as well as those of Suess, Lacroix, Michel-Levy, Lapparent, Armand Gautier, and Albert Brun; and an account by Prof. Forel of the labours of the International Seismological Association.

As already stated, some of the most interesting work connected with the subject of Section IV. (Glaciation) was done in the general sittings held in the Aula, but among the other papers of this section may be

mentioned that of Prof. Cvijić (Belgrade), on "Pleistocene Elevations as a Cause of Glaciation;" that of Prof. Loczy (Budapest) on "The Relations between the High Glacial Terraces and the Three Fluvial Terraces of the Plains of the Middle Danube;" and that of Prof. Hamberg (Upsala) on "The Parallel Structure of Glacier Ice."

In Section V. (Hydrography) the President, Prof. Forel, read a paper on "The Origin of the Fishes of Lake Leman," in which he expressed the conclusion that in post-glacial times there must have been a communication between that lake and the Lake of Neuchâtel. Some of the most interesting papers belonging to this section were read at a joint meeting with Section VII. (Meteorology). At that meeting a paper was read by General Schokalsky on the fluctuations in the level of the lakes of Central Asiatic Russia, in which it was pointed out that there had been a rise in their general level in recent years, a fact opposed not only to the theories held of a general desiccation now going on, but also to what was to be expected in accordance with Prof. Brückner's theory of a thirty-five year period of temperature and rainfall. In a subsequent paper Prof. Woeikof pointed out that the data as to temperature and precipitation derived from several Russian and other stations were also discordant with Prof. Brückner's theories. An animated discussion followed, in the course of which Prof. Brückner replied to his critics.

In Section VI. (Oceanography) Prof. O. Petterson read an interesting report on the work done by the International Council for the Exploration of the Sea, whose headquarters are at Haarlem (Netherlands), and Dr. Gerhard Schott (Hamburg) spoke of the latest oceanographical work done by the German navy.

In Section VII. (Meteorology, etc.) one of the most important papers read was that by the president (Prof. Hellman), giving an account of a new method of estimating the fluvial régime of a locality. Prof. Kassner (Berlin) exhibited and described his meteorological globes designed for use in teaching.

In Section VIII. (Biological Geography) Prof. Jaccard (Zürich) showed that the distribution of vegetable species followed a mathematical law in respect of their degree of frequency; Prof. Tanfilief (Odessa) demonstrated the preponderant influence of the temperature of soil in determining the limits of species and especially forest limits in Russia; and Dr. Hochreutiner, Conservator of the Botanical Museum, Geneva, treated of the affinities between the flora of Madagascar and those of the extreme east and south of Africa.

In Section IX. (Anthropology) Prof. Lenz, the acting president, read a paper comparing the Jewish populations of Abyssinia and Morocco; Prof. Colocci (Catania) read one on the migration of peoples, and more particularly on the immigration into the west from Central Asia. An interesting address on Chinese art, illustrated by a fine

collection of Chinese paintings, was read in the same section by Mrs. Olga Julia Wegener.

The papers read in Section X. (Economic and Social Geography) were very numerous. Prof. Vidal de la Blache, one of the vice-presidents, read a paper on the geographical interpretation of regional units (*des paysages*), in which he showed the influence of climate, valleys, slopes, etc., on the distribution of human settlements and cultivation. Prof. Alfred Bertrand described the country of the Barotse, formerly explored by him. Dr. Day (Washington) spoke of the oil-bearing deposits of the world; Prof. Brigham (Hamilton, New York State), of the numerous and complex factors affecting the distribution of population in the United States;* His Excellency Oliveira Lima, Brazilian Minister at Brussels, on the method of penetration into the interior of Brazil; Prof. Blondel (Paris), on the development of Hungary, Miss L. A. Owen (St. Joseph, Missouri), on the Missouri river and its future importance to the natives of Europe;† M. César de Givenchy, on the economic and social evolution of Tunisia since the establishment of the protectorate.

In Section XI. (Exploration) Captain Harfeld (Brussels) gave an account of his explorations in the Chinese province of Hunan; Baron Hulot, general secretary of the Society of Geography, Paris, set forth the results of the recent French explorations in Algeria and Tunisia and the regions behind them; Mr. H. L. Bridgman (New York) sent a paper on the history and field work of the Peary Arctic Club; and a paper by Dr. W. S. Bruce (Edinburgh), on his explorations in Prince Charles Foreland, Spitsbergen, 1906–1907, was read in his absence by Miss Newbigin, D.Sc., editor of the *Scottish Geographical Magazine*.

Mention has already been made of one of the most important discussions in Section XII. (Education). Among other papers read in that section were one by Dr. Silva Telles (Lisbon), on the teaching of geography for advanced students; one by Count A. de Fleuriac on the teaching of geography by school journeys; one by Dr. A. Michieli (Treviso), on international vacation courses in geography; and one by Prof. Hobbs (Michigan), describing an ingenious apparatus designed to enable those learning geography to realize the meaning of contour-lines by determining and plotting those of model earth-forms, much in the same way as an engineer actually determines and plots the contours of the Earth's surface.‡

In Section XIII. (Historical Geography) the president (Prof. Cordier) presented to the Congress his memoirs on the Consulate of

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* Published in the present number of the *Geographical Journal*.

† This paper, we understand, will appear in full in an approaching number of the *Scottish Geographical Magazine*.

‡ The full account of this apparatus will appear, we understand, in a future number of the *Scottish Geographical Magazine*.

France at Canton in the eighteenth century, and on the general correspondence relating to Cochin-China, 1785–91, and read some notes on recent explorations made by the French in Eastern and Central Asia. He also laid on the table a manuscript of M. Hamy, of Paris, on the voyage of André Michaux in Syria and Persia in 1782–85, which will be published in the Report of the Congress, and in the name of M. H. Vignaux, principal secretary to the embassy of the United States at Paris, he presented to the Congress that author's work on Toscanelli and Christopher Columbus, as well as a volume in which M. Vignaux proves that the date of the birth of Columbus is 1451. In the same section the Brazilian minister at Brussels gave an account of the negotiations of his country with almost all her neighbours for the settlement of her frontiers by arbitration or treaty; Prof. Ed. Naville (Geneva) gave a very full account, supported by references to authorities, of the commercial relations of ancient Egypt with neighbouring peoples; Count Teleki (Hungary) showed his collection of ancient Spanish and Portuguese maps of Japan, which will be published at Budapest in October; Dr. Scott Keltie (who was elected one of the vice-presidents of the section) read a paper on recent geographical progress in Great Britain; M. de Luigi (Milan) exhibited a Chinese map of the world, compiled by a Jesuit missionary in the seventeenth century, which he had found in the Ambrosian Library at Milan; and Mrs. Z. Nuttall (Coyoacan) sent to the Congress an unpublished account of Drake's circumnavigation of the globe, given by his prisoner the Portuguese pilot, Nuño de Silva, before the tribunal of the inquisition in Mexico, on the 23rd of May, 1579.

Of the papers read in Section XIV. (Rules and Nomenclature) one excited animated discussion. It was that prepared by Prof. Ricchieri (Milan), and presented in the joint names of Profs. Cordier (Paris), Sieger (Graz), Ricchieri, and of Mr. Chisholm (Edinburgh), proposing the appointment of a commission to study the question of the transcription of geographical names. In the end the meeting adopted the proposal, and at the general meeting of the Congress held for the consideration of general resolutions, the following resolution was unanimously adopted: "That the Congress should appoint a commission of seven members charged with the duty of studying the question of the transcription of geographical names in all its aspects, . . . with the view of preparing a complete report of such a nature that the next Congress may be able to come to a definitive conclusion on this important question." The mandate of the commission is to terminate one year before the meeting of the next Congress, and its report is to be published at that date. Profs. Cordier, Penck, Ricchieri, Sieger, and Mr. Chisholm were nominated as members of the commission, with power to select the two other members.

In addition to those already mentioned, the following resolutions

and recommendations were adopted at general meetings of the Congress. At the meeting held on July 28 a resolution with regard to the map of the world on the scale of 1 : 1,000,000 was unanimously adopted in the following terms :—

"Whereas the map-making offices of several nations are engaged in compiling maps, to be published on a uniform scale of 1 : 1,000,000, under uniform agreements as to limits of sheets, etc.—

"Resolved that it is desirable, for manifest reasons, that a uniform set of symbols and conventional signs be adopted by all nations for use upon these maps.

"Resolved that an International Committee should be formed to consider the question, and that, in order to provide a basis for the discussion, each Government and other map-producing office should be requested to supply to the committee, within the next twelve months, specimens of the 1 : 1,000,000 maps which have been produced."

In accordance with this resolution, the president of the Congress nominated a provisional committee to consider the question, to report to the Congress, and make the necessary recommendations. The committee met, and unanimously adopted the following recommendation: "That the thanks of the Congress should be expressed to the Governments of France, Germany, the United Kingdom, and the United States for having begun the execution of this important work, and that the results of their efforts should be communicated by the Congress to the other Governments interested in cartography."

The committee proposed, further, that the following recommendations should be communicated in the name of the International Congress to the Governments interested and to the geographical societies represented at this Congress :—

"1. In accordance with the recommendation made by the International Geographical Congress held at London in 1895, each sheet of the map should embrace an area of 4° in latitude and 6° in longitude. The limiting meridians of the sheets should be at successive intervals of 6° reckoned from the meridian of Greenwich, and the limiting parallels at intervals of 4° reckoned from the equator. The meridians and parallels should be drawn on each sheet for each degree.

2. The projection, according to the recommendation of 1895, should be polyconic, that for each sheet being constructed independently on its middle meridian.

3. A kilometre scale should be given on each sheet. An additional scale in miles might be added if desired.

4. The altitudes above sea-level should be inserted in metres. Heights in feet might be added if desired.

5. Contour-lines should be marked at vertical intervals of 200 metres, starting at sea-level; but in very mountainous districts the vertical intervals might be greater, provided that they were multiples of 200

metres. In very flat countries additional contour-lines might be given provided that the intervals were fractions of 200 metres. These lines should be drawn in brown. Minor features which cannot be indicated by contour-lines should be shown by shading. As a complement to the contour-lines, it is desirable that the successive zones of altitude should be indicated by a system of colour tints. A definite scale of tints should not be decided upon until after the preparation of specimen sheets on the general lines of these recommendations.

6. Generally water should be shown in blue, but a distinction should be made between perennial and non-perennial streams. The depths of the sea and of lakes should be shown by blue contours, the vertical intervals being multiples or fractions of 200 metres. Features which cannot be shown by the contours may be shown by blue shading. The datum level in each case is to be the surface of the sea or lake. In the case of rivers, rapids and other obstructions to navigation are, as far as possible, to be indicated.

7. Roads and tracks should be divided into two classes —those which are suitable for wheeled traffic, and those which are not.

8. The lettering should be in varieties of the Latin characters. A distinction should be made between the lettering applied to cultural (artificial) features and the lettering applied to natural features. In those cases in which the Latin characters are not in use in the country in which the sheets are produced, two editions should be published, one the national edition, and one the international.

9. A clear distinction should be made between the representation of features known to have been surveyed with sufficient accuracy to render any subsequent important alteration improbable, and the representation of those features which have been imperfectly surveyed or only roughly explored."

In pursuance of a proposal brought forward at one of the meetings of Section I. by General de Schokalsky for the formation of an International Cartographic Association (such as had already been proposed at previous congresses), the President of the Congress, at the request of that section, nominated a committee to consider that proposal, as well as one laid before the same sectional meeting by M. Schrader for showing in a simple and distinct manner the progress of exploration over the world in the manner indicated by him in a *répertoire graphique* exhibited by him. This committee recommended (1) that the proposal of M. Schrader should be adopted; (2) that the committee should be continued as a permanent committee of the Congress, with authority to take steps towards the publication of such a *répertoire;* and (3) that the action proposed by this committee, taken in conjunction with that of the committee of the map of the world on the scale of 1:1,000,000, should be considered as constituting the first and most practical step towards carrying out the work of the International Cartographic Association.

In the event of these propositions being adopted by the Congress, the committee proposed to proceed as follows:—

(*a*) To prepare a plan for the general publication of the *répertoire graphique;* to draw up an estimate of the cost of publication of successive editions of the *répertoire* under the responsibility of several map publishers, and thus to ascertain the price at which it could be delivered to subscribers.

(*b*) To invite the principal geographical societies to publish in their *Journal* a specimen sheet, chosen by the committee, of the *répertoire* as prepared by M. Schrader, with the addition of an explanatory text prepared by the committee, and a statement of the conditions on which the *répertoire* might be supplied to subscribers.

(*c*) To proceed with the publication of the *répertoire* if, in the opinion of the committee, the subscriptions were sufficiently numerous to warrant the enterprise.

(*d*) To bring about collaboration with the view of keeping the *répertoire* up to date.

On the proposal of Commander Roncagli, delegate of the Italian Geographical Society, authority was given to the presidency of the Congress to appoint an international committee to study in a systematic manner a project for the establishment of an International Bureau to answer geographical inquiries in the interests of commerce.

The Congress also adopted the resolution brought forward by M. H. Arctowski, that it desired to place on record its sense of the importance of completing forthwith the systematic exploration of the polar areas, and of utilizing the experience gained in recent Antarctic expeditions by following up without delay the success that has been achieved.

Finally, the Congress recommended that geographical societies should seek to interest their respective governments in the reproduction of the cartographic remains of antiquity, the Middle Ages, and the Renaissance, and nominated a committee consisting of Prof. O. Nordenskiöld, Mr. K. Miller, M. G. Marcel, Prof. Oberhummer, and C. Perron, to promote the carrying into effect of this desire, and to present to the next Congress a catalogue showing what ancient maps have been reproduced in facsimile, and indicating in order of importance the old cartographic material which it was particularly desirable to have reproduced.

As usual, various excursions were organized in connection with the Congress, and an admirable handbook of excursions was drawn up.

In his opening address to the Congress, the President of the Swiss Confederation, while stating that the members were not to expect the sumptuous receptions which they had had in some of the great cities of the world in which previous congresses were held, gave the members the assurance of very cordial hospitality on the part of the city and people of Geneva. This modest assurance was amply justified. Everything

was done to make the stay of the members in the city agreeable. The crowning act of hospitality was a steamboat excursion on the Lake of Geneva on the fourth day of the meeting, an excursion that was favoured with ideally propitious weather.

Invitations were given by several towns for the next meeting of the Congress, but only two entered into serious competition at the meeting of delegates held to consider this point—one from Budapest for the year 1912, the other from Rome for the year 1911. The meeting decided by a majority of votes in favour of Rome.

SIXTEENTH INTERNATIONAL CONGRESS OF AMERICANISTS AT VIENNA, SEPTEMBER, 1908.

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S.

The International Americanist Congress met at Vienna from September 8 to 14, with the Archduke Rainer as Patron and eight honorary presidents, of whom her Royal Highness the Princess Theresa of Bavaria, the distinguished South American traveller, was present through all the meetings. The inaugural addresses were delivered in the great hall of the university.

Out of the forty-four papers, the majority were strictly archæological, ethnological, or linguistic, but there were several of geographical interest. Prof. Franz Ritter von Wieser of Innsbruck described the "mappe-monde" of Pierre Destelier, 1553, the property of Count Wilczek. He also presented the Spanish text, with facsimiles of the maps, of the "Islario General" of Alonso de Santa Cruz, cosmographer of Charles V. It is a valuable and very interesting result of the geographical researches conducted by the emperor's cosmographers. Another ancient map of America, date 1526, was described by Dr. Denucé of Brussels. Miss Adela Breton, who has been occupied for some time at Mexico in copying a very ancient and curious plan of Tenochtitlan, exhibited her careful and admirably executed work at one of the meetings. It excited great interest, and wishes were expressed that it might be made accessible. This curious relic will probably accompany the translation of Bernal Diaz which Mr. Maudsley is editing for the Hakluyt Society, in some form or other. But there is a difficulty in reducing the scale, owing to the loss of interesting details.

Dr. Franz Boas is well known to geographers for his researches in Baffin Land. He gave the congress an account of the results of the Jesup Expeditions in the Alaska regions. An equally important paper, from a geographical point of view, was that on his researches on the coast of Esmeraldas (Ecuador), by Mr. Marshall H. Saville of New

York. The physical aspects characteristic of the coast of Peru terminate near Tumbez, and from the Gulf of Guayaquil northwards across the equator, the conditions being different, the appearance of the coast is changed. This coast of Ecuador, therefore, presents features of special geographical interest, which have never been so well described and illustrated as by Mr. Saville, whose main object was, however, archæological research.

Other papers had some bearing on geography, especially Dr. Preuss's account of Indians in the Sierra Madre of Mexico; Dr. Schmeltz and Jonkheer Panhuys on expeditions in Surinam, Don Manuel Peralta on Central America, and Dr. Thalbitzer of Copenhagen, who had passed a winter with the Eskimo of East Greenland. Prof. Juan B. Ambrosetti, the director of the ethnological museum at Buenos Ayres, came with the results of his very interesting researches in Tucuman; and Prof. Max Uhle arrived from Lima, where he has for some years directed the museum of national history with distinguished ability with communications which were of great interest.

The members of the Congress were entertained on Sunday the 13th by Count Hans Wilczek at his castle of Kreuzenstein, and on Monday there was a reception in the town hall. All the arrangements were good, and this sixteenth meeting of the Congress of Americanists was a decided success.

AN UNCONVENTIONAL MAP OF THE WORLD, AND A PLEA FOR ITS USE IN SCHOOLS.

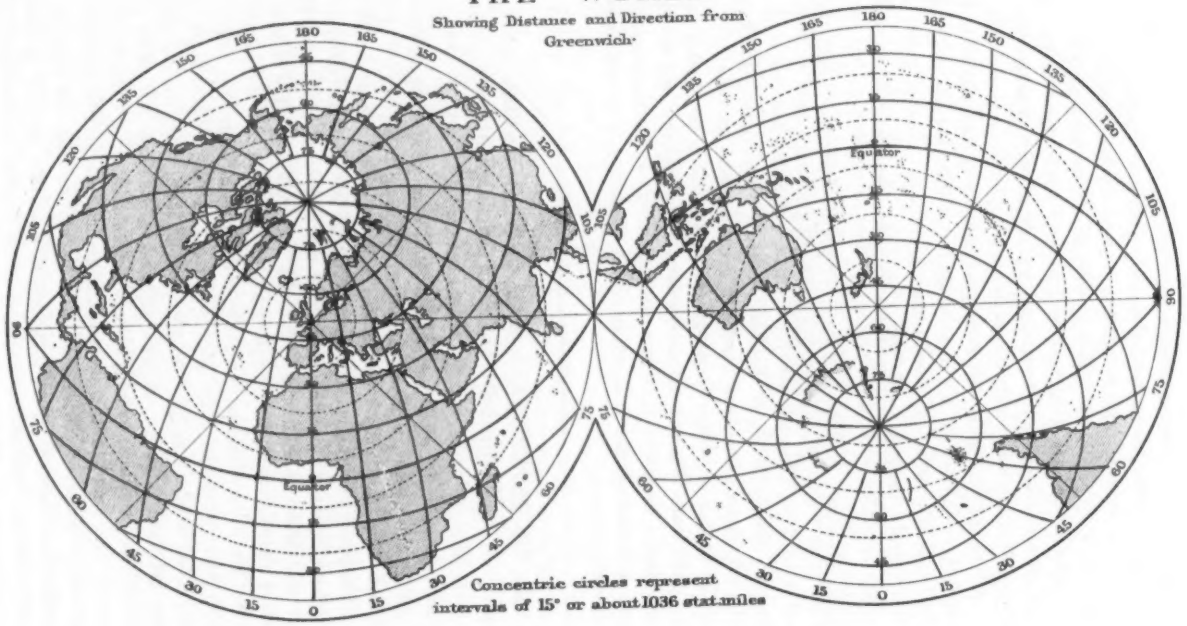
By R. D. OLDHAM.

Having occasion, for a purpose unconnected with geography, to construct a map of the world on an arrangement differing from any in ordinary use, and from any map which I was able to procure ready made, the result appeared so instructive and useful for educational purposes that I venture to place it before readers of the *Geographical Journal* in the hope that some enterprising publisher may take up the matter, and prepare a similar map on a larger scale for adoption and use in schools.

We are all acquainted with the conventional Mercator map of the world, constructed on a projection which has many advantages, apart from those which render its uses almost obligatory in navigation. These are, that it preserves the compass bearings true for every point, the north and south line being always perpendicular, or directly up and down the map; and that it shows at a glance the relative latitude and longitude of different places. Its drawbacks are that the scale is not constant, the size of equal areas on the Earth's surface increasing rapidly with the latitude, and that it gives a most misleading impression of the relative size and position of places not situated on or near the equator. The proper corrective for these defects is a much more

THE WORLD

Showing Distance and Direction from Greenwich.



Concentric circles represent intervals of 15° or about 1036 stat. miles

extended use of the globe in teaching, but, unfortunately, the globe is not adapted for class demonstration, and something in the way of a map is required which will help to correct and complete the deficiencies of the Mercator projection.

At present there is practically nothing but the well-known "world in hemispheres," in which the surface of the globe is arbitrarily divided into an eastern and a western hemisphere. This represents fairly well the disposition of places on the Earth's surface relative to the centres of the maps, but as these centres lie in the open ocean on the equator, and therefore in a place where no one lives, and to which no one wants to go, the arrangement is devoid of that practical application which it would have if the place in which the map was to be used were adopted as a centre. In England we should naturally adopt London, or, what is practically the same, Greenwich, and obtain a map like that which illustrates this paper.

It will be seen that this map is very different in appearance from those to which we are accustomed, and at first sight the shapes of the land areas seem incorrect. Who, for instance, has seen such an America as is here depicted. Yet if it is compared with maps to be found in atlases, and allowance made for the curvature of the meridians and parallels, it will be seen that the distortion is not greater, but merely in a different direction from that to which we are accustomed.

This question of distortion is an interesting one. Some distortion is inevitable in any attempt to represent a part of the surface of the globe on a flat map, and when the whole of a hemisphere is represented, the distortion must necessarily be considerable in some part or other of the map. Whatever may be done within the map, its diameter must always represent the same distance as one-half of the circumference, and in a circular map the ratio of these two lengths is 1 : 1·57—that is to say, there must be a distortion of at least 57 per cent. in some part or other of the map, and the only thing to be decided is the form which this distortion is to take. We may preserve the shape of each small area and vary the scale, or we may keep the scale constant and submit to a distortion of shape. As the object of the map was to show the position of places relative to Greenwich, it naturally became desirable to maintain a constant scale of distance along lines drawn outwards from the centre, and what is known as the zenithal projection was adopted. The general distortion on this projection is less than on any other, with one exception; it is less than 10 per cent. in the central part of the map, up to a distance of two-thirds of the radius from the centre; it increases in the outer part, but only at the extreme edge does it reach that limit of 57 per cent. which cannot be avoided somewhere or other in the map.

Adopting this projection, we get a map on which all points at equal distances from the centre lie on a circle, whose radius is directly

proportional to the di ance, and a straight line drawn from any point to the centre represents the direction in which the great circle or line of shortest distance starts. Constructed with London as a centre, for use in England, it seems to correct some common but erroneous impressions. It is seen, for instance, that Jamaica lies nearly due west; that Bombay and Perth, W.A., both lie almost due east, and that the direct and shortest line to Calcutta starts in an east-north-easterly direction; also it shows that when Captain Scott started southwards from the *Discovery* winter quarters towards the pole he was really making a bee-line for home.

Many other curious results come out from a study of the map, some of them more clearly, and certainly more conveniently, than on a globe, and it seems that a map of this kind, side by side with the Mercator map, would make a more useful combination than any at present procurable.

THE DISTRIBUTION OF POPULATION IN THE UNITED STATES.*

By Prof. ALBERT PERRY BRIGHAM.

THE United States had, in 1900, a population of about 76,000,000, an allotment on the average of 25·6 persons to each square mile. In an area not greatly larger Europe had at that date 390,000,000 people, giving a density of 101. It is convenient to remember that the density is about four times as great in Europe as in the United States.

Comparing the new country with three of the European peoples, Great Britain, with an area smaller than that of the state of Colorado, had more than 41,000,000 people, and showed a density of 470, while England exhibited a density of 605. Belgium, less than one and a half times as large as the small state of Massachusetts, had a density of 616, ranging from a minimum of 130 in Luxemburg to 1027 in Brabant. The kingdom of Italy is not much larger than the state of Nevada. This state had, in 1900, less than one person per square mile. Italy, in 1901, had 32,000,000 people, and showed an average density of 293, while the province of Lombardy had 456 persons to each square mile. The vast and diversified Dominion of Canada, on the other hand, greater than its southern neighbour, had less than 6,000,000 people, and exhibited a density of about 1·75 to the square mile.

CENTRE OF POPULATION.

The centre of population in 1900 was in the state of Indiana. In 1790 the centre was 23 miles east of Baltimore, in the state of Maryland, or virtually on the Atlantic shore-line. Its migration has been slow and remarkably uniform, both in rate and in direction. It has hovered for one hundred and ten years along the 39th parallel of latitude, and its total variation in latitude has been less than one-third of one degree. The westward movement has averaged less than a degree in a decade, notwithstanding the incredibly swift occupation of a vacant continent by a movement of population westward. The easterly position of the

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* Read before the Ninth International Geographical Congress, Geneva, July, 1908.

centre of population is in part due to the fact that the eastern part of the continent was first settled, and was settled from the east. The population wave has always been rolling up on the Atlantic lowland, before pushing its crest across the Appalachian highlands. The easterly position of the centre of population is also due to the more evenly distributed and more abundant resources of the eastern half of the United States. It should not be forgotten that the geographical centre of the United States lies some hundreds of miles west of the Mississippi river. The eastern half of the country therefore embraces the Atlantic lowlands, the prairies and Great Lake plains, the Gulf lowlands, and the forests and minerals of the Appalachian mountains and Appalachian plateaux. Over against these are the arid and mountainous areas of the west. Certain areas will be reclaimed to incredible productiveness, and the mineral wealth is vast: but the centre of population may be expected to remain permanently to the eastward of the geographical centre of the land.

Density by Divisions.

The North Atlantic division of the official census includes the six New England states and the middle states except Delaware. It is essentially the group representing the northern colonies of early days. Here the density is 129·8. The South Atlantic division ranges from Delaware to Florida, including thus the old southern colonies and Florida. Here the density falls to 38·9, less than one-third as compared with the most sparse district of Belgium. We may compare the North Atlantic and South Atlantic divisions. The northern climate is classed as temperate, with severe winters. The southern climate is temperate to sub-tropical, but not at any point of latitude is it such as to repress population by excessive heat. The northern division has in the main a glacial soil as against a residual soil in the south. The northern division is largely mountain and plateau, with well-matured and fertile valleys, and the south combines with higher mountains equally rich valleys, and superadds a vast extent of coastal plain in a most hospitable climate. In both north and south are ample rainfall and forests. If the physical advantage lies anywhere, the balance would seem to incline to the south.

From the point of view of physiographical relations, the north has a shorter passage from Europe, which may be viewed as important, especially as the more active colonizing and commercial powers of Europe lie in northern latitudes. The north has better harbours than the south, and, perhaps more important than all else, holds the easier passes of the Appalachians.

Historically, early settlements north and south were nearly contemporaneous in Massachusetts and Virginia, as at other points in both regions. But small holdings, free labour, and varied culture obtained in the north, while the plantation, slave labour, and less varied culture, as of cotton and tobacco, ruled in the south. It remains for the economist and the sociologist to measure the force of these influences in retarding the growth of the south. The geographer, however, is safe in concluding that the larger and facile geographical relationships of the north went far to obscure any local advantages of soil and climate of which the south was possessed.

The north-central division includes the five states north of the Ohio river, also Minnesota, Iowa, and Missouri on the west bank of the Mississippi, and the Dakotas, Nebraska, and Kansas farther west. The density in this division is 34·9. If we omit the four first-named, as extending in part into the arid belt, we shall have a more homogeneous area, and shall find a density of between 50 and 60. If we remember that this is the most fertile great area in the United States, we may observe with surprise that the density is less than half that of the North

Atlantic division. The explanation is had in the fact that it is much younger and that it is mainly agricultural. It has its great population centres, as Chicago, but it has not yet so fully reached the manufacturing and commercial stage of evolution as has the North Atlantic division, with its innumerable mills, factories, and town centres, and the intensive agriculture that accompanies urban population.

On the other hand, the north-central division has larger density than the much older South Atlantic. This is due to its intimate ancestral relation to the east, to its ample commercial relations with the Atlantic seaboard, to the richness of its soils, and to a more favourable industrial and social system.

The South Central Division includes the States between the Ohio river and the Gulf, and westward to Oklahoma and Texas. Here the density is 23·1. This figure is low, and yet Kentucky, Tennessee and Arkansas are as rich in soil and mineral wealth as the North Atlantic division, while Oklahoma and the Gulf states as a whole are aboundingly favoured in soil, climate, in forests and mineral wealth. The only material exception is the interior of the Texas, where large areas belong to the arid and mountain regions. We must take account here, however, of the repressive influence of slavery, of the comparative inaccessibility of the interior states of this group, and of the remoteness from Europe of the Gulf coast. Aready, however, these repressive conditions are losing their force, through the change of social conditions, the recognition of natural wealth, the improvement of the great waterways of the Mississippi and Ohio, through the extension of railway systems, the building of highways and the general evolution of industry.

The Western division includes the Cordilleran region from the western edge of the great plains in Colorado and Wyoming to the Pacific coast. The density is 3·5, and the explanation of the sparseness is close at hand. It is a region of recent occupation, of vast areas of aridity, of extensive mountain surfaces, and much of it even yet is comparatively inaccessible. It awaits the fuller work of irrigation through private and federal enterprise, the further exploitation of its coal and its precious metals, the regulation of railway traffic and the opening of the Isthmian canal, with increase of commercial life for the great states lying on the Pacific shore line. This enlargement may be expected to follow not only upon easier communication with the east, but in perhaps large measure, may be due to relations with Alaska and the Orient.

Extremes of Density.

The greatest density exhibited by any state as a whole, is found in Rhode Island, where the figure is 407. Even in this small state the population is locally concentrated, and a recent writer has shown that but 6 per cent. of the people live west of a north and south line bisecting the state. This western half of the area is more and more given up to the forest.

Massachusetts is next in the scale, having a density of 348·9; New Jersey follows with 250·3, and Connecticut is fourth, with 187·5. These densities in no sense represent the capacity of the soil, but are due to concentration in commercial and manufacturing towns. A large part of Massachusetts is occupied by the mountainous region of the Berkshires, with few people. On the other hand the Connecticut valley and much of the coastal lowland are crowded with towns and with small and intensively cultivated farms. The same is true of the uplands and the Connecticut valley, in the state bearing that name. In New Jersey, we find the density hingeing entirely upon the proximity of two great cities, New York and Philadelphia, lying beyond the bounds of the state. Much of her territory is mountain upland, and sparsely peopled coastal plain.*

* Paper by R. H. Whitbeck, read before the Association of American Geographers, Chicago, 1907.

The small densities appear in the western division. This region has more than twelve times the area of the United Kingdom, and bears a population less by 1,000,000 or more than the single city of London. The range is from a fraction of one person, as in Nevada, to about ten, in California. Only one state east of the Mississippi river fell below a density of ten in the year 1900. This state was Florida.

Rural Density.

If we omit all centres having a population of 4000 or more, we shall have remaining the agricultural population, and the villages and hamlets whose industries are essentially a part of the rural life. We may here distinguish what we may call the *rural density*, and thus may gain a rude measure of the extent to which the soil itself is occupied. The total density and the rural density for the several divisions are thrown here in tabular form.

	Total density.	Rural density.
North Atlantic division	129·8	43·3
South Atlantic division	38·9	31·2
North Central division	34·9	22·5
" " " (omitting the Dakotas, Nebraska, and Kansas)	—	34·1
South Central division	23·1	—
" " " (excluding Texas) ...	—	27·5
Western division	3·5	2·4

It thus appears that the country east of the arid belt shows rural densities ranging from 27·5 to 43·3. If we now remember that the North Atlantic division has a large number of manufacturing villages with populations falling under 4000, we see that the rural density is more uniform than the figures indicate. This is yet more clearly shown under the following heading.

Density of Agricultural Workers.

The United States census for 1900 enables us to exhibit the number of actual agricultural workers for the whole country and its several divisions. The table shows the number for each square mile and the consequent number of acres which receive the labour of one man. The arid belt and all states to the west of it are omitted except in the first item.

	Number of workers per square mile.	Acres each worker.
Whole country	3·5	182·0
North Atlantic division	6·6	97·0
South Atlantic division	7·5	85·3
North Central division (omitting five states as above)	6·4	100·0
South Central division	7·6	84·4

Averaging, it appears that within the region of sufficient rainfall, we find seven agricultural workers for each square mile, or one worker for each 91·4 acres. The

uniformity, or the approach to this average, of each of the great divisions seems worthy of remark. These figures refer not to land in actual tillage, but to the entire land-surface of the several regions.

In each of the divisions except the North Atlantic the acreage under the care of one worker decreased from 1890 to 1900, showing thus a progress toward intensive culture. In the North Atlantic division in that decade the average per man increased from 94·4 to 97 acres. This was no doubt due to the passage of farms or fields into pasture and forest. The real movement in that region, as in the others, is toward intensive farming.

Special Areas of Surface and Soil.

Two examples are taken from the state of New York. The table gives the density and the rural density of four selected counties.

	Density.	Rural density.
Hamilton	2·8	2·8
Chenango	43·2	35·4
Delaware	30·3	30·3
Orleans	76·1	5·3

Hamilton county is wholly mountainous, and nearly all bears forest, being part of the pre-Cambrian Adirondack region. There are no villages worthy of mention, and the two densities are the same. It is a different world from the Palæozoic lands to be found within 50 miles in any direction.

Chenango and Delaware counties belong to the Devonian uplands of the Appalachian plateau, and to that section locally known as the Catskills, and their extension westward. Altitudes of 1500 and 2000 feet prevail, except in the deeper valleys. The chief industry is the dairy, and the towns are small, so that the two densities are equal in Delaware and similar in Chenango.

Orleans county belongs to the lake-plains of the Iroquois region; its surfaces are chiefly level, its soils rich, and its climate ameliorated by the great reservoirs of lake-water. Cereals and fruits rule; the county contains thriving towns, but no cities; and the rural density rises to 53.

The next example relates to surface as well as soil, and has primarily to do with communication. We may well define a *transportation belt* in New York, namely, the counties lying along the New York Central and Hudson River Railway. This railway passes from the city of New York along the Hudson, westward by the Mohawk pass, and along the lake-plains to the foot of Lake Erie.* Few American routes are so well known in Europe as this. The counties bordering this line of railway contain about 30 per cent. of the land-surface of the state, and they hold 77 per cent. of its population. They contain all the cities rising above a population of 100,000, namely, New York, Syracuse, Rochester, and Buffalo. The belt, indeed, includes all the cities surpassing the limit of 50,000, with one possible exception. This is the route also of water communication from the lakes to the sea, and it is in itself peculiarly favoured in its lacustrine and alluvial soils, and in its milder winter climates, as compared with the uplands on either hand.

* "The Eastern Gateway of the United States," A. P. Brigham, *Geographical Journal*, London, vol. 13 (1899).

Similar discriminations, on the basis of physical geography, could be indefinitely multiplied by examples from other states, such as North Carolina, Wisconsin, Kentucky, Missouri, or Alabama.

Cities of the First Order.

The next analysis will relate to the great cities, and must be in outline, for any adequate treatment would demand a separate paper. We rank as cities of the first order, all having a population of 250,000 or more in the census of 1900. There were sixteen such cities. Washington was one of these, but we omit it from further consideration as having been wholly special in its origin and development.

The remaining fifteen fall into three groups of five each—marine, lacustrine, and fluvial. The marine cities are Boston, New York, Philadelphia, Baltimore, and San Francisco. Two of these are on estuaries and three are on tidal bays, while four are Atlantic ports, and one belongs to the Pacific. In order of population of cities of the first order they stood (1), (3), (5), (6), (8).

The lacustrine cities are Buffalo, Cleveland, Detroit, Chicago, and Milwaukee. Detroit is, indeed, on the short Detroit river, but is no real exception, as it derives its chief importance from its relation to lake traffic. Three of these cities are on or closely related to Lake Erie, and two are on Lake Michigan. There is no great city on the American side of Lake Ontario, the presence of Niagara having forbidden it. And there is no great city on Lake Huron or Lake Superior, although Duluth's importance is not to be measured by its present population. Of Lake Superior it is to be said that it is too far north for domestic trade across the continent, and it is bordered by a rugged region of mineral and forest. The population rank of the lacustrine cities was (2), (7), (8), (13), and (14).

The fluvial cities are Pittsburg, Cincinnati, St. Louis, New Orleans, and Minneapolis-St. Paul. The last is composed of two municipalities, but their situations and their history constitute them essentially a single-river city. New Orleans may be considered as partly marine in its type. Of this group two are on the Ohio river and three on the Mississippi, all belonging to the Mississippi System.

Of the entire fifteen, only one is west of the 93rd meridian, and but three are west of the Mississippi river, two of these being upon its banks. All but one also are in the Atlantic basin.

If we consider cities between 100,000 and 250,000, we find them twenty-one in number in 1900. Of these, four may be regarded as dependencies of great cities—Newark, Jersey City, and Paterson as related to New York, and Allegheny as virtually a part of Pittsburg. Of the remaining seventeen, three are tidal—Providence, Fall river, and New Haven; and six are fluvial—Louisville, Kansas City, Omaha, St. Joseph, Memphis, and Rochester. One of these centres, Scranton, is based on the mining of coal, three are state capitals, Denver, Indianapolis, and Columbus, and one, Toledo, is lacustrine. Indianapolis would now rank as of the first order, and, like Denver, has important relations other than to the government of its state. The three remaining centres, Syracuse, Worcester, and Los Angeles, are inland towns of various origin.

Concentration of Industries.

The building of a great industry in a region, or in a specific centre, modifies in important ways the distribution of population. The United States abounds in illustrations of this principle. Such gatherings arise in relation to natural resources, such as combinations of soil and climate. Indian corn may be termed a prairie product, although widely distributed beyond the prairie region. Hot

summers and wide areas of fertile soil have led to such enormous productions of this crop in Illinois, Iowa, and adjoining lands, that it may fairly be cited as an example of concentration even though other grains are largely grown. The live-stock industry follows the corn, though by no means coincident with it, since the natural pastures of the plains reach far beyond the corn belt. The oranges of Florida, or California, the peaches of Niagara, the grapes of Chautauqua, and the fruits and vegetables of the Atlantic coastal plain offer further examples.

The Cordilleran States abound in groups of population centred around a single industry, usually agriculture or mining, and the one is as striking and conspicuous as the other. If the rush of people for gold in California was spectacular and dramatic fifty years ago, the concentrations due to fruit and grains are scarcely of less absorbing interest in the central valley of the San-Joaquin and the Sacramento at the present time. The Willamette valley in Oregon, the plantations of Utah, and the farms about Greeley, in Colorado, afford noble examples of agricultural concentration in a region where deposits of silver and gold are more commonly remembered as explaining the origin of population groups.

Concentration due to mineral resources is well typified by Pittsburg, where, however, facilities for transportation and relation to other important centres must not be forgotten; or we may turn to the Southern Appalachian valley, where coal and iron are the dominant factors, supplemented by agricultural conditions of a high order.

Resources in the form of power have played a most important part, and perhaps our most available illustration is southern New England, where the streams and waterfalls were obviously and instantly available in a time when coal had not been exploited, and when there were no transportation facilities worthy of the name. Water-power determined the industry and the dense populations of that region, even though fuel power now plays so large a part, and other interests enter in to baffle analysis.

Resources of mine and soil must always combine with favourable transportation. Pittsburg has been cited, and Cleveland, Buffalo, and New York, among others, might be studied with the utmost profit in this connection. The products may be of remote origin, as are the iron and the grain in relation to Buffalo, but the concentration is sure, if the site is in the track of inevitable movement, as determined by grades, navigable waters, and by the position of other growing groups of population.

When a great centre has been established in response to such conditions of environment, then the needs of the population enter as a further factor to react on environment, and give colour and character to all surrounding life. Thus the agriculture of New York and New England has been modified, not only by competition from without, but even more profoundly by the needs of New York and Boston. The single requirement of dairy supplies for these cities largely controls the agriculture for a radius of 300 miles. The growth of these cities, the perishable character of the product, and the imperative needs of millions of people, have almost revolutionized the farming of these regions within a single generation.

The distribution of resources of raw material, of power, and transportation routes is fundamental, but the historical order in which they are found and brought to use is also important, because interests once established are conservative, and tend to hold their place. This inertia will be effective until the tendency to a more natural balance becomes overwhelming. Under such impulse we are brought to the—

Migration of Industries.

The migration of industries, in the course of more perfect adjustment to nature, may or may not involve the movement of the populations engaged. As the centre of wheat and other grains receded from Western New York to Ohio, to Illinois, to the trans-Mississippi prairies and plains, the movement involved a vast transfer of population, because a new country was exploited, and the same movement is now going on toward that possible vaster wheat centre of coming years in the plains of Canada.

Another migration is in progress, viz. that of cotton manufacture, which appears to mean a shifting of occupation rather than of people. So far as New England may be forced to retire from this field she will turn to other toil the hands of her people. So far as the south may avail to carry her own product from the gin to the loom, she will do so by training her own people to new skill. That labour is mobile is indeed shown by the existence of the large French Canadian mill population of New England, but there seems no reason to predict that any considerable body of New England people will, under an industrial impulse, seek the south.

Capacity of the United States for Population.

The data thus reviewed serve to raise this interesting question, although failing to afford foundation for more than general conclusions. In the long run, the number of people which a land can support depends, not only on the kind and amount of soil, but upon all other resources, and upon the economic condition of all the countries with which relations are maintained. The sources of error in such computations are numerous and grave.

It has been estimated that the Mississippi valley could support 250,000,000 as well as it now supports 41,000,000 people.* Smaller farms, more effectively utilized, would be needed. Prof. A. B. Hart, writing of the future of the Mississippi valley, compares this region with the valleys of the Hoangho and Yang-tse-king, and concludes that the American valley could comfortably maintain 350,000,000 people. There seems room, however, to compare carefully the standards of "comfort" obtaining on the plains of China in the past, and those standards which will prevail in the fertile heart of the United States in future ages. It cannot be a matter of interest for the geographer or the historian to know how many human beings can maintain a bare existence within a given territory. Further comparisons, however, seem to justify Prof. Hart's estimate, and certainly bear out Mr. Justin Winsor's figure of 200,000,000. The Hart estimate gives a density of 282. Remembering that Belgium has 616, we are requiring but 46 per cent. of the resources needed for the present scale of living in Belgium, a country in which the standard of comfort would seem to be reasonably high. We make due allowance also for the waste, arid lands of the Mississippi valley. In forest and mineral riches our valley seems equal to Belgium, and the future will bring its transportation facilities to comparable completeness. We may accept freely the view that the forests of Kentucky, Tennessee, and Georgia are capable of supporting a population as the Black Forest or the Jura.

The island of Java has recently been taken as an example of large capacity for population.† With an area slightly above 50,000 square miles, the island had in

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* Mr. F. A. Ogg, 'World's Work,' vol. 12, October, 1906.

† A. Weikoff, 'Annales de Geographie,' vol. 10, 1901.

1896 a population above 26,000,000, and a density of 518. The island raises its own food, and the writer thinks that 106,000,000 people could here live with ease, and with suitable variety of food. This means a density of 2000. The author works towards the general conclusion that the equatorial belt of 30° in width could safely support 10,000,000,000 people, or seven times the present number of our race. We here again raise the query, whether, if rice enough for subsistence could be grown, other things having exchange value could be produced to provide for the comforts and general advantages of civilized life. And before adopting Java as a criterion for the Mississippi valley, we must observe that rice grows in but a small part of the valley, and that the future people of that region can hardly be expected to make rice their staple food. It would remain, therefore, for the careful student to compare the quantity and nutritive value of the various cereals with those of rice. We should further take into account the annual successions of crops possible to a luxuriant tropical region.

Illinois.

As a limited area, and therefore capable of more exact comparison, we may take this great prairie state. It has a land area of 56,000 square miles. Its population in 1900 was nearly 5,000,000, and its density was 86. Again we compare with Belgium, which has an area less than one-fifth as great, a population greater by nearly 2,000,000, and a density sevenfold greater. The density of Belgium would give Illinois nearly 35,000,000 people. The density of Java would give the prairie state 29,000,000, the area not being greatly different. England is not quite as large as Illinois, and has over 30,000,000 people. The density of England would give Illinois nearly 34,000,000.

There is almost no waste land in the state, and the soil is of high quality. It is probable that in food capacity in proportion to its area Illinois surpasses any of the above examples from the older continents. In other resources she excels in coal, nearly two-thirds of her surface being underlaid by beds of this fuel. She can raise timber if she can spare the land, but is deficient in most metallic minerals. She is prospectively as favoured as any land in commercial and transportation facilities, focussing the trade of the transcontinental railways and of the Great Lakes, and to be open soon to the full possibilities of Mississippi and Isthmian navigation. We may thus conclude that this single state can and will enormously increase its population. But it is not safe to prophesy in figures.

The United States and its Future Population.

If we exclude the arid and mountainous regions of the West, what remains would appear to have as great an average capacity for population as England. If we take the point of view of soil and topography, it would seem that the poor areas of our Appalachian uplands were amply offset by the meadows and thin pastures of the Pennine range, of the English lakes, and of Devon and Cornwall. England has reclaimed her fens, and we have the probable estimate that as much good land can be reclaimed by drainage east of the Mississippi river as by irrigation to the west of it. As regards abundance of general resources for export, the United States are more favoured than England in coal, iron, petroleum, and copper, while her climatic range puts into her hands maize, tobacco, rice, sugar-cane, cotton, and all sub-tropical fruits.

Let us see our results, on the basis of equality with England, in the population capacity of the eastern United States. We omit the Western division, Texas, Kansas, Nebraska, South Dakota, and North Dakota. It is perhaps surprising

that but little more than two-fifths of our territory remains, although including a full tier of States west of the Mississippi river. With a density equal to that of England, this eastern part would contain 742,000,000 people. It remains for our posterity to see how far these theoretical possibilities become real.

Summary Analysis of Factors controlling Distribution.

The present discussion has given sufficient evidence that these factors are many in number, complex in action and difficult of analysis. They are at the same time interesting, because of the wide range and sharp contrasts in the physical conditions, and because of the brief history and swift changes of the United States.

We enumerate (*a*) soil, rainfall, and temperature, which issue is what we may call *crop-capacity*. Thus, even if no other factor operated, Belgium must, by virtue of these conditions, always have a much greater population than Norway. Massachusetts, as we have seen, has a density of 349, while Illinois, far richer in the produce of the soil, shows but 86. This means that other factors have wrought and still are powerful. A second factor, or group of factors, is (*b*) the mineral, forest, and power resources, leading to concentration of industries and to corresponding massing of population. A simple case is found in the large towns and cities of the region of anthracite coal in Pennsylvania. The coal lies in a rugged tract which, but for this mineral, must ever have been sparsely peopled. Other examples have been given in the brief account of conditions of concentrations. We name (*c*) physiographical relations. This factor, as we have seen, goes far to explain the dense populations of the North Atlantic, as compared with South Atlantic states. It is further illustrated by the transportation belt in New York, and by the growth of such centres as Chicago and Denver. Finally, (*d*) historical and social conditions must never be neglected. However reluctant the geographer may be to step beyond his own sphere, he must reckon with the character of races and the march of events through the centuries. Indeed, we may be assured that the complex adjustment of the human race to our planet will be truly interpreted for the geographer, when the problem has long been studied from the points of view of geography, history, ethnology, political economy, and social science. It would be rash to conclude that the above, or any proposed catalogue of factors influencing distribution, is complete.

In conclusion, the following general deductions seem, to the writer, important and appropriate :—

(1) The distribution of population, casually studied, offers to geographers an important field of research.

(2) The distribution of population, so studied, should have a large place in geographical and historical education.

(3) Such study promotes the scientific organization of geography, because it unfolds a process of progressive adjustment to environment.

(4) A young country, such as the United States, offers opportunity for such investigation, because of its physical variety, its brief history, and the resulting facility with which its changes can be seen and interpreted.

THE PRESENT AND FUTURE WORK OF THE GEOGRAPHER.*

By Major E. H. HILLS, C.M.G., R.E.

THE thirty years that have elapsed since the British Association last met in this city of Dublin have seen an obvious and rapid progress in the science of geography, and a steady, though perhaps not quite so apparent a change in the character of that science.

In 1878 large parts of the Earth's surface still remained untrodden by the feet of a white man; large areas were open to the enterprise and intrepidity of the explorer; large spaces were blank paper upon our maps. Now there is but little of the Earth's surface absolutely unknown.

It is not my intention to detain you by any recapitulation of the work of these years to show you how and by whom these areas have been traversed and the gaps in our maps filled in. I intend rather to speak of the present and of the future work of the geographer, and to do this to any advantage we must at the outset recognize the change that has taken place in the nature of his task, and the fact that the days of individual exploration are over, never to return. We must recognize that sporadic, unorganized effort must be and is being replaced by organized, systematic work, and that the scientific traveller of the last century, with his rough map-making equipment, his compass, watch, and sextant, has yielded his place to the scientifically equipped survey party, with their steel tapes, theodolites, and plane-tables.

The theme is not a new one to this section. I find, on referring to the transactions of past years, that in 1902, at the Belfast meeting, Sir Thomas Holdich, the President of Section E, said, "We find those spaces within which pioneer exploration can be usefully carried out to be so rapidly contracting year by year as to force upon our attention the necessity for adapting our methods for a progressive system of worldwide map-making, not only to the requirements of abstract science, but to the utilitarian demands of commercial and political enterprise."

The words express succinctly the ideas that I wish to take as the text of my address to-day. I am, however, not ambitious enough to attempt to cover the whole surface of the Earth in the brief review that I intend to put before you of the progress of scientific survey. Rather I wish to restrict our outlook to that section of the work in which we may all be considered as having a direct personal interest, namely, the survey of the British Empire, especially those lands under the more immediate tutelage of the Government of this country. Let it not be thought, however, that while we for the moment pay little attention to the regions lying outside this definition, we are supporting the fallacious idea that the survey of any part of the Earth can be considered apart from the survey of the surrounding country. With the possible exception of the case of an oceanic island, such an assumption would be an erroneous one. Our British empire is so widespread and our possessions are so often in close and intricate juxtaposition with those of other nations that there is in this work large scope, and indeed necessity, for international co-operation. Examples of this will occur to us in the course of our review. We shall thus see that in addition to the obvious connection which the geography of our empire has with that of other countries there is an

* Presidential Address to the Geographical Section, British Association, Dublin, September 3, 1908.

even closer connection in the methods of manufacture of that geography, which methods we summarize under the general term of survey. One of the root ambitions of the scientific surveyor is to determine the exact figure of the Earth, an operation for which observations spreading over a large area of the Earth's surface are demanded. In fact, we may truly say that the problem of the Earth's shape will not be completely solved until the whole surface is known to the surveyor. This is, therefore, pre-eminently a problem for international solution.

Before proceeding to the consideration of our special subject, the survey of the British empire, it will be interesting to interpose a few remarks on the questions of the utility and origin of national surveys in general. We may first note the somewhat curious fact that the production of a map of a country, useful as such a work is for many purposes, has almost always been embarked upon because the imperative necessity of maps of the theatre of operations in war has been brought home to the people and Government of a nation. Thus the ordnance survey of England had its first beginning in a military map of the highlands of Scotland, commenced in 1747, intended to facilitate the operations of the troops under the command of the Duke of Cumberland. It was not till many years later that the systematic triangulation of the country was undertaken, a work which was initiated partly for map making and partly for astronomical purposes. There was a consensus of opinion among astronomers that it would be greatly to the advantage of that science if the observatories of Greenwich and Paris could be connected by triangulation, and the famous French astronomer Cassini, in October, 1783, drew up a memoir to this effect. The arguments brought forward convinced King George III., and he granted a sum of money sufficient to enable the work to be started. This act of royal generosity was recorded by the surveyors in the following grateful terms: "A generous and beneficent monarch, whose knowledge and love of the sciences are sufficiently evidenced by the protection which he constantly affords them and under whose auspices they are daily seen to flourish, soon supplied the funds that were judged necessary. What his majesty has been pleased to give so liberally it is our duty to manage with frugality consistent with the best possible execution of the business to be done."

It is worthy of remark that the junction of the triangulation systems of Great Britain and France was not made until 1861, and that the trigonometrical connection of Greenwich and Paris observatories has not yet been completed to the final satisfaction of men of science—a point which we shall have occasion to recur to later.

In France, we may note in passing, the starting of the triangulation had a quite different and quite definite object, the determination of the length of the metre. This unscientific unit of length was fixed as a fraction (1 : 10,00,000) of the quadrant of the Earth's surface between the pole and the equator, and to find this quantity it was necessary to measure on the Earth's surface as long an arc of the meridian as could be obtained.

In the case of our other great national survey, that of India, its origin is to be found in circumstances somewhat analogous. The Madras Government, owing to the success of the British arms in the Mysore campaign, found itself with a great accession of totally unsurveyed country in the middle of the peninsula, while at the same time there were only in existence the roughest sketch-maps of the older possessions. It was apparent that if any map, of even approximate accuracy, was to be made covering a country of such vast area, it was imperative that the work should be prosecuted upon the most rigorous and strictly scientific basis. The general lines upon which it should be undertaken were laid down in February, 1800, by Brigade-Major Lambton, who addressed a letter to

the Madras Government advocating a mathematical and geographical survey of the Peninsula.

In this letter he discussed the principles upon which such a survey should be based. He dismissed astronomical fixations as not providing the requisite degree of precision, observing that such determinations of position are liable to great inaccuracies, "three, four, perhaps ten minutes," and proposed a triangulation emanating from a measured base line checked by similar base lines at intervals. He recognized that the figure of the Earth and lengths of the polar and equatorial radii were not then known with the precision necessary for fixing the spheroidal co-ordinates of the trigonometrical stations of a survey covering such a large area of the Earth's surface, and that a geodetic survey was therefore necessary *pari passu* with the geographical survey. He had an impression, how derived it is not now possible to say, that there was a sudden abnormal diminution of the force of gravity at the latitude of 10° N., and consequently that "a degree on the meridian from that parallel to the Equator must be very short compared with a degree to the northward of 10°." He observed that it would be necessary to "attend to this circumstance," which he characterized as important both from the map-making and from the rigorously scientific point of view. He added, "I shall rejoice, indeed, if it should come within my province to make observations tending to elucidate so sublime a subject."

In a similar case, occurring in recent years, the outcome has not been so satisfactory. It will be within the recollection of all here how at the time of the South African war the public at home learnt with shocked surprise that there were no maps in existence of a colony which had been under the British flag for a long period of years. To those who knew the facts this was, naturally, no matter of surprise; but it was earnestly hoped by many that this grave deficiency thus revealed by the stress of war would be remedied by quiet work in the time of peace, and that, at the conclusion of the military operations, the foundation should be laid for a federal survey department of British South Africa comparable with, though on a more moderate scale than, the Survey Department of India. This hopeful scheme, which it may be recorded very nearly came to fruition, ultimately found political conditions too adverse, and had to be indefinitely postponed. An army engaged in field operations in the north of Natal now, or in fact at any time for an indefinite number of years in the future, would find the country nearly as mapless as it was found by Sir R. Buller in 1900.

In this short recital of the determining causes which have in the past led to the initiation of national surveys, it will have been noticed that no allusion has been made to what we should now perhaps consider the main utility of a map—namely, its value for all purposes connected with the ownership, development, and taxation of land. When the ordnance surveys of Great Britain and Ireland were originated there was little thought of this use, and it was not till long after that period, when the enormous deficiencies of the existing property plans were revealed by the Tithe Commutation Act and by the railway boom, that the value of a national survey for preparing a cadastral or large-scale property map of the country was recognized and acted upon. Now this is often the ostensible object for embarking upon a regular survey. It is fully recognized that, especially in the case of a country undergoing rapid development, which is fortunately true of many of our oversea possessions, the provision of an accurate land map is of prime necessity both to the private or corporate landowner and to the State.

Neither were any of the early surveys undertaken for the purpose of mutual delimitation of international boundaries; a necessity which has in recent years been the stimulating cause for many pieces of valuable survey work, especially in Africa.

The other manifold uses of a map are familiar to all of you and we need not pause to enumerate them. We may admit the fact that the adequate mapping of its territories is recognized as one of the duties of a civilized State. Let me now turn to the main subject of this address—the inquiry as to how far this duty is performed by us, what shortcomings we can perceive, and what suggestions we can offer for the future.

Two years ago this task would have been a difficult and laborious one. Now it is greatly facilitated by the issue from the Colonial Office of those excellent little volumes, the reports of the Colonial Survey Committee.

This body has been in existence since August, 1905, and has published three annual reports. The Committee is therein defined as an advisory one formed at the instance of the Secretary of State for the Colonies to advise him in matters affecting the survey and exploration of British colonies and protectorates, more especially those in tropical Africa. It is not at present an executive body, that is to say it has at its own disposal no grant of public money or other funds; whether it will ultimately develop into such is a question that the future alone can answer. Even thus limited in scope and powers it has, however, already worked a notable improvement—firstly, by laying down authoritatively some of the more salient conditions that ensure the efficient and economical expenditure of whatever funds may be available, and by pointing out the disastrous extravagance of unsystematic and unmethodical work; secondly, by insisting upon uniformity where uniformity is essential, such as in matters relating to the style, projection, scales and sheet-lines of the maps produced, while leaving the utmost latitude as to methods, these being selected in each case to suit the very divergent nature of the country met with. It results from this that any two small portions of the map of Africa, say, for instance, one sheet of the dense forest region of the Gold Coast and another of highland country of East Africa, though 3000 miles apart and executed at different times by a different staff, will match each other in general character, and will ultimately be found to fit exactly into their places as constituent parts of a great map of the country. Thirdly, we may reckon the mere fact of publicity in these matters as of no mean advantage. Though, as in the case of many other Government publications, this report is not as widely read as its merits deserve, yet it is all to the good that the information is there ready and available for anybody who has the curiosity to consult it. I, therefore, welcome the opportunity of drawing your attention to this volume.

In entering upon the discussion on the survey of British Africa, the first point that meets us is the geodetic basis of the whole work; upon what do the actual positions depend? In other words, to put the matter more familiarly, how are we to provide that every isolated piece of the map will exactly fit into its proper place? The only method for ensuring this is by basing all our surveys ultimately upon a skeleton or framework of geodetic or primary triangulation executed with the utmost attainable precision. Such a skeleton, or rather backbone, will eventually exist in Africa in the shape of the meridional arc, or chain of triangles, along the thirtieth meridian, running right through the country from north to south, and ultimately joining on to the great arc observed by the famous astronomer Struve. This originally extended from the mouth of the Danube to Hammerfest, in Norway, an amplitude of 25½° of latitude. To prolong it southward, passing up the Nile valley, through the heart of tropical Africa, across the Zambezi river, and terminate it at the southernmost point of the continent is a magnificent conception due to Sir David Gill, to whose energy and enterprise the actual execution of considerable sections of the undertaking must also be ascribed.

At the present time the chain has been completed from the south to within 70 miles of the southern end of Lake Tanganyika, a distance of about 1700 miles. At Lake Tanganyika it will enter Germany territory. The German Government, fully recognizing that the project is not only of great theoretical interest, but also of immediate practical value, are already taking steps to start work on their own section, from the south of Tanganyika up to the parallel of 1° S. lat. From 1° S., northward to about 1½° N. the arc lies near the boundary between the Congo Free State and the British Protectorate of Uganda. An International Commission is at present engaged in the survey of the boundary region, and Sir D. Gill, ever ready to seize an opportunity of forwarding the work he has at heart, succeeded in raising sufficient funds, partly from the Treasury and partly by grants from a few leading scientific societies, to enable an observer to be sent out with this Commission to carry the arc over this section. North of this point the line comes into the territory of the British Sudan, and traversing this eventually reaches Egypt proper. Here it comes into the charge of Captain H. G. Lyons, the director of the Survey Department of Egypt, under whose care its interests are safe.

It will thus be seen that while the actual completion of the whole chain is as yet somewhat remote, we are in the satisfactory position of being able to say that, as far as the section lying on the continent of Africa is concerned, there is no portion of which there is no reasonable probability that it will be finished within a measurable period. With regard to the section joining Africa and Europe the position is not so happy. This will run through Palestine and Asia Minor, and therefore lies in Turkish territory. It is not likely that the Turkish authorities either will or could carry out such a work; in fact, seeing that even when completed it would be totally useless to them, it would be hardly reasonable to expect them to do so. It must, therefore, presumably be a matter for international co-operation. One point may be mentioned with regard to the exact route of this connecting section. Sir D. Gill, in his Report on Geodetic Survey of South Africa, 1896, said—"By an additional chain of triangles from Egypt along the coast of the Levant, and through the islands of Greece, the African arc might be connected by direct triangulation with the existing triangulation of Greece, and the latter is already connected with Struve's great arc of meridian which terminates at the North Cape in latitude 71° N. The whole arc would then have an amplitude of 105°." This, however, gives rather a poor connection with the European triangulation. The South Albanian series has a much higher average error than either Struve's original work or any part of the African series. This portion would consequently be a weak link in the geodetic chain, and it would be better to avoid it altogether by carrying the line along the coast of Asia Minor to Constantinople, and then up the east side of Turkey to the mouth of the Danube.

When we look back a few years and call to mind the prominent part that this country has taken in the survey of Palestine—I need only mention in this connection the names of Kitchener, Warren, and Conder—we cannot avoid a feeling of regret that we are not ourselves in a position to take the whole execution of this section of the line upon our shoulders. I am too well aware of the many urgent claims upon the Treasury to suggest that it is possible that they would be prepared to incur such a charge; but supposing, for the moment, that part of the necessary funds could be provided from other sources, I think we may fairly urge that it is our duty to contribute a substantial monetary grant towards the furtherance of an end so desirable and so practically useful.

The difficulty of obtaining money for geodetic work, the benefit of which is not immediately apparent to the man in the street, is notorious. Thus Sir T. Holdich,

in 1902, said, "But this accurate framework, this rigorously exact line of precise values which ultimately becomes the backbone of an otherwise invertebrate survey anatomy, is painfully slow in its progress and is usually haunted by the bogey of finance. It does not appeal to the imagination like an Antarctic expedition, although it may lead to far more solid results, and it generally has to sue *in formâ pauperis* to Government for its support." To account for this regrettable, but undoubtedly true fact two reasons may be adduced. There is, in the first place, the possible ignorance as to the ultimate value of the work; but, secondly, and perhaps not least, there is the fear, not entirely unjustified, that to satisfy the demands of the scientific man is something akin to the operation of filling a sieve with water. It has been so often seen that compliance with one demand only leads to another being made, that we may well sympathize with the holder of the public purse when he draws the strings tight and refuses to pay for an arc along the thirtieth meridian in the fear that directly this is completed he will be asked to pay for one along the twentieth meridian, and then along the tenth, and so *ad infinitum*. It behoves us, therefore, as practical men to make sure that our demands are reasonable and limited to the actual requirements of the case, and where such limits cannot be set we should make this fact clear at the outset. When, however, it is possible to set such limits, we should not hesitate to do so; and in the case of the African arc this latter course is fortunately possible.

If we take the map of Africa we shall see that the arc along the thirtieth meridian passes through, or near, all the colonies of British South Africa, close to British Central Africa, or Nyasaland, through Uganda, and is thus connected with British East Africa, through the British Sudan and through Egypt. There remain absolutely untouched by it only the West African colonies—Nigeria, the Gold Coast, Sierra Leone, and the Gambia. These latter will eventually get their geodetic framework by an extension southwards of the French triangulation of Algeria, a work of a high order of precision. We are therefore entitled to say—and I take this opportunity of saying it with all due emphasis—that with the exception of some triangulation to join the West African Colonies with the French triangulation, the arc along the thirtieth meridian is the only primary triangulation required for the adequate mapping of the whole of British Africa. The remainder of the geodetic framework can be supplied by ribs of secondary triangulation branching out from the main backbone, such as the line already completed along the boundary between British and German East Africa, passing to the north of the Victoria Nyanza, and thence westward to the thirtieth meridian.

You will observe that I here speak only of the triangulation required for mapping purposes, not of that demanded by the geodesist for the study of the figure of the Earth. The latter is satisfied only with a survey of the highest attainable precision covering as large an area of the Earth's surface as possible, or at all events with arcs, both meridional and longitudinal, at frequent intervals. It cannot be other than a very long period before the whole of Africa is surveyed upon this scale of accuracy, and in the mean time we must devote ourselves to the far more urgent duty of mapping the country, leaving the more remote and abstract task to our descendants, well satisfied if in our hands the foundations have been well and truly laid.

Furthermore, as we shall see presently, if we are prepared to recognize as a national duty the minutely precise survey of our own land and of all territories under our flag—and I do not see how any reasonable man can withhold this recognition—then there are duties of this nature lying closer to our hands than any to be found in Africa.

Having thus passed in brief review the ultimate geodetic basis of our African surveys, let us enter more into detail and glance at the actual survey work now in progress in the different regions of the continent.

In British South Africa, as we have already noted, the political conditions are at present unfavourable to any comprehensive scheme of operations. There is, however, in progress a first-class topographical survey of the Orange River Colony and a reconnaissance survey of Cape Colony. The former is an excellent example of the class of work that can be done by a small military party of the highest technical training working upon systematic lines, and I should like to devote a few minutes to a short description of the methods adopted and of the results obtained.

The survey party consists of two Royal Engineer officers and four non-commissioned officers, the former undertaking the triangulation and the general supervision of the field work, and the latter the plane-tabling. The positions are primarily based upon the points of the geodetic survey broken up into a secondary triangulation with sides averaging 10 miles. In 1907 the average triangular error of the secondary work was 2·9 seconds of arc, and the greatest linear errors of displacement, as tested by the geodetic triangulation at the end of a chain 45 miles long, were 3 feet in latitude and 2 feet in longitude. The probable error of a trigonometrical height was under one foot. You will see, therefore, that the accuracy is ample for all mapping purposes, even upon large scales, and the degree of precision is in excess of that demanded for a topographical map on the scale of 2 miles to one inch. The rate of progress and the low cost of work are, however, no less notable than its accuracy. The actual rate of out-turn is about 8 square miles per day per man, or for the whole party 23 square miles of detail survey per diem, and the number of trigonometrical points fixed about three hundred per annum. The cost works out to about 8*s.* per square mile of the completed map, and the whole area of 47,000 square miles will be finished, printed and published in five and a half years.

These remarkable results are due in a large measure to the energy and organizing power of the officer in charge, Captain L. C. Jackson, R.E. The detail survey is done in sheets fifteen minutes square, each non-commissioned officer being given one complete sheet, which he works at until finished. Four such sheets are therefore in progress at any given time, and each sheet takes about six weeks. Seeing the rapid rate of progress maintained it might perhaps be thought that the country is a particularly easy one for the topographer. Such is, however, by no means the case. It is true that there is an entire absence of the surveyor's greatest impediment, large areas of dense forest, but there is much broken and difficult country, rising in places to altitudes of above 7000 feet.

In Cape Colony the reconnaissance survey is of a somewhat similar character, but owing to the large area of the country and to the small amount of money available the work has perforce to be of a more rapid nature. In Natal, Bechuanaland and Rhodesia no survey is at present in progress.

Passing northward through Africa, we come to the British Protectorate of Nyasaland, formerly called British Central Africa. Of this country a certain number of maps exist purporting to give topographical detail; but as they are not based upon any framework of triangulation, and as much of the detail only depends upon rough sketches, it is impossible to say how far they can be accepted as correct representations of the ground.

It is most unfortunate that financial considerations prevent the execution of any systematic trigonometrical survey. The absence of such, and the fact that maps are being made which must inevitably be withdrawn and replaced by others in the future, will undoubtedly be the cause of ultimate waste of money.

Passing northward again we come to the large and important protectorates of British East Africa and Uganda, in both of which systematic surveys are in hand. The geodetic framework is supplied by a triangulation along the Anglo-German boundary, connected with chains of triangles along the railway in the neighbourhood of Nairobi. In Uganda proper there is also a triangulation covering a substantial area. As already noted, all this work will eventually be tied into the thirtieth meridional arc, though it is not likely that the final adjustment of geodetic positions thus arrived at will necessitate any substantial alterations upon the maps.

In both protectorates topographical surveys are in hand, and maps on the scale of 2 miles to an inch will be issued. In British East Africa, under the able direction of Major G. E. Smith, R.E., rapid progress is being made. This topographical mapping is additional to the cadastral maps also in progress in both countries. These latter are required for property purposes, in Uganda for demarcating the estates given over to the native inhabitants of the country under the agreement of 1900, and in East Africa for attachment to title-deeds of lands alienated for farming or stock-raising.

In the Sudan the enormous area of the country—over 1 million square miles—and the limited funds available have prevented any systematic survey being taken up. A large amount of reconnaissance mapping has been done, and a series of sheets on the scale of 1/250,000 (4 miles to an inch) have been published. These are corrected and improved by officers and Government officials as opportunity offers. The energies of the Survey Department are almost entirely spent in meeting urgent local requirements in the shape of cadastral maps of the cultivated areas along the river.

Somaliland, a British protectorate, which came into unfortunate prominence a few years ago, is a country of too small value to be worth the cost of any sort of survey, and the only maps that exist are based upon the route sketches of travellers and sportsmen and upon the work done by a small section of the Survey Department of India during the military operations five years ago.

Leaving the east side of Africa and turning our eyes westward, we may note that in the colony of the Gold Coast a rigorous survey was rendered imperative by the gold-mining boom of 1901. The work was entrusted to Lieut.-Colonel Watherston, C.M.G., R.E. Owing to the dense forest covering practically the whole country triangulation would have been prohibitive in price and very slow in execution. The initial positions were therefore fixed by a network of long traverses, executed with all possible refinements with steel tapes and theodolites. Astronomical latitudes were observed by Talcott's method at every 50 miles. The errors of misclosure of the traverses proved to vary from about 1 in 2000 in unfavourable cases to nearly 1 in 6000—results inferior to triangulation, but at the same time sufficiently accurate to form the basis of a map with no appreciable errors *on the paper*. One great defect of the traverse method of fixing points lies in the practical impossibility of carrying the heights through without occasional checking, either by lines of levels or by trigonometrical observations. Such work makes therefore an imperfect basis for topography, and would only be used when natural features compel its adoption.

Northern Nigeria is a country of enormous area, and, up to the present, of small revenue. It has therefore not been found possible to allocate the funds for any systematic mapping. The existing maps are compilations based upon sketches made by civil and military officers when travelling upon duty and upon the surveys made by the different Anglo-French and Anglo-German boundary commissions. In 1905–6 Captain R. Ommaney, R.E., fixed the astronomical longitudes

of fifteen towns by exchange of telegraphic signals with Lagos. With the aid of these values, combined with a number of astronomical latitudes, it has been possible to combine the material into something like a complete map. It need, however, hardly be pointed out that astronomical fixations are liable to large and uncertain errors, due to the variation of local attraction, and cannot attain the precision of even a rapid triangulation. In Southern Nigeria the experience has been somewhat unfortunate. This colony has spent a very substantial sum upon its survey department, and if the work had been properly organized and systematically carried out we should by now be in possession of a complete map of a large portion of the country. Unluckily, the mistake has been made of detaching survey parties for non-geographical purposes, such as the erection of telegraph lines, work doubtless urgently required in the interests of the colony, but not lying within the sphere of a survey department. Thus systematic progress was rendered impossible, and, though isolated pieces of triangulation and long lengths of traverses have been done, no topographical map of any area yet exists.

Of the remaining West African colonies the Gambia river is a narrow piece of land with boundaries running parallel to the river banks, and, except for the actual trade along the river, is unimportant. In Sierra Leone the country in the immediate vicinity of Freetown was surveyed by the colonial survey section, a small party employed by the War Office for the purpose of making surveys of places of special military importance. The map of the remainder of the colony is a compilation based on miscellaneous material.

In the course of this summary of the state of the mapping of British Africa mention has been made of the surveys made by joint commissions appointed for the delimitation of international frontiers. No small part of the existing map is due to work of this class. Thus joint Anglo-French commissions have marked out the frontiers of the Gambia, Sierra Leone, the Gold Coast and Nigeria; Anglo-German commissions the eastern boundary of Nigeria, the boundaries between British and German East Africa, between German East Africa and North-East Rhodesia from Lake Nyasa to Tanganyika, and between Bechuanaland and German South-West Africa; Anglo-Portuguese commissions the frontiers between Portuguese East Africa and North-East Rhodesia and Nyasaland respectively. Useful surveys have also been made in the course of the mutual demarcation of the frontiers between Abyssinia and the Sudan on the west and British East Africa on the south; also of the frontier between the colony of Sierra Leone and the Republic of Liberia.

Important as the work done by these commissions has been, its value would be greatly enhanced if the report of each commission were published in a succinct and easily accessible form. Such reports would naturally contain a record of the actual frontier as finally ratified, and also a technical account of the survey methods employed. They would thus be of permanent use both to the official or officer on the spot for the easy settlement of any disputes that may arise, and to the chief of any future boundary commission as an aid to the selection of the methods of survey most suitable to the particular country with which he is concerned.

Up to three years ago many of the African protectorates were under the tutelage of the Foreign Office, while the older colonies were under the Colonial Office. The reports of Boundary Commissions are therefore scattered through official documents in the two offices, and are drawn up upon no uniform model. Now that the superintendence of all these territories has been handed over to the Colonial Office, and that body has set itself such an excellent example in the appointment of the Colonial Survey Committee and the publication of its reports,

it is greatly to be hoped that they will follow up the good work and systematize and publish all these Boundary Commission reports. If a model for such a publication is desired, I may refer to the account of the demarcation of the Turko-Egyptian frontier between Rabah on the Mediterranean to the Gulf of Akaba, lately issued by the Egytian survey.

The account which I have endeavoured to give you, short and imperfect as it is, of the present state of the mapping of British Africa will have shown you clearly that there is a large amount of excellent work now in course of execution, and that there has been, especially during the last few years, very considerable progress made towards co-ordinating this work and towards maintaining certain fixed standards of accuracy, rapidity and economy.

It will naturally occur to you to inquire whether this co-ordination could not advantageously be pressed a step further, and whether all the isolated survey departments, now working in the various colonies and protectorates, could not be amalgamated under one executive head; whether, in fact, a Survey Department of Africa, precisely analogous to the Survey Department of India, could not be formed. The advantages of such a step are obvious, but must not be allowed to blind us to the difficulties. We have, in the first place, the objection to be met that the South African colonies would, under present circumstances, almost certainly refuse to join in any general scheme, and would not consent to any arrangement whereby money raised in one colony would be spent outside its own geographical limits. If, however, we leave South Africa out of the question the financial difficulty tends to disappear. Both our East and West African possessions are, in general, not yet in a position to maintain themselves, and are still, and will be for some time to come, partially supported by grants from the Imperial Treasury. To divert a portion of these grants to pay for the maintenance of a survey department would only be a matter of account and could be adjusted so as to cause no hardship to any one colony. There remains the geographical difficulty of space. The fact that the heads of the department would have to keep in close personal touch with countries differing entirely in character, and perhaps three months' journey from each other, does not appear to offer any insuperable objections, and I cannot avoid expressing the hope that it may be found possible at a no very remote date to take some steps in the direction of a consummation which appears so desirable.

In giving my evidence before the Royal Commission on the War in South Africa, presided over by Lord Elgin, I outlined the general features of a scheme under which the Imperial Government would undertake the topographical mapping of all our oversea possessions, apart from self-governing colonies. As on this occasion I was considering the whole question more exclusively from the military side, no reference was then made to the question of cadastral maps, and it was tacitly assumed that these would fall to be constructed by the land office or a land survey department belonging to each separate colony. On the present occasion we are not restricted to the military point of view, but are permitted a wider outlook. Our task is to consider the map in all its aspects, both as regards its method of construction and its ultimate use, whether for military, administrative, engineering, or purely scientific purposes. This enlargement of our scope does not, I think, modify our previous conclusions, and were I now called upon to devise a scheme for the mapping of British Africa, I should base it upon the principle of a central Imperial body for executing the triangulation and topography, leaving the land survey to local organizations.

The arguments in favour of this policy are manifold. As regards the triangulation they hardly require stating. It will be obvious to all that such work

must be closely co-ordinated, and that some central, directing head is imperatively called for. The enormous waste of money that is ultimately involved by tolerating imperfect work, of which many examples could be cited, is alone a sufficient justification for holding this view. We may, however, pause to examine a little more closely into the advantages of centralization as regards one particular operation in a survey. That is the measurement of the initial base line upon which the accuracy of the whole framework depends. This task used to be one of the most laborious and difficult with which the surveyor is confronted. The apparatus employed, some form of compensation bar, was cumbrous and difficult to use, the site selected had to be levelled, and the preparatory alignment carried out with the most scrupulous care. Thus the Loch Foyle base for the triangulation of Great Britain and Ireland was about 6 miles long, and the actual measurement, quite apart from the time spent on the preparation of the ground, took sixty days, an average rate of work of just over 500 feet per working day.

A few years ago the discovery was made of the nickel-steel alloy with a very small or zero coefficient of expansion, the so-called invar. This valuable metal, by abolishing the necessity for any temperature correction, has enormously simplified all physical measurements of length, and, *à fortiori*, those measurements, such as base lines, which are perforce done in the open air and over a large range of temperature. Survey bases are now measured with an invar wire stretched to carefully regulated tension, and either laid along a flat trough, or, what appears to give equally good results, hung freely between supports. The gain in precision due to the avoidance of errors of expansion or contraction in the measuring apparatus is substantial, while the gain in rapidity is very great. Thus, as a contrast to the Loch Foyle base, let me give a short account of the measurement of a base in Spitsbergen by the Russian party of the joint Swedish and Russian missions in 1900, extracted from a review already written for the *Geographical Journal*.

The conditions for accurate work were very unfavourable: no site even approximately flat could be found, and the base was therefore irregular in contour and traversed rough and in some parts marshy ground. The weather conditions were far from ideal. The cycle of operations was as follows: An auxiliary base 175 metres long was measured with Struve's apparatus, twice before the main base measurement and twice afterwards. The two wires used for the main base were standardized on this subsidiary base four times, twice before and twice after use. The main base, 6·2 kilometres long, was measured twice in each direction by each of two wires, eight measures in all. The limit of error in the final value was 17 millimetres—say, one part in 360,000.

The whole of these operations, including the laying out of the standard and the comparison of the wires, were completed in a period of three weeks; Monsieur Backlund, who superintended the actual measurement, left the observatory at Pulkowa on June 11 and returned to it on July 24. It was, therefore, possible to standardize the wires not only by the check base upon the spot, but also by the permanent standards of the observatory within three weeks of their use for the actual measurement. It need hardly be pointed out that this was eminently favourable to the attainment of the highest exactitude, and we have here a marked example of the value of centralization. The proposed trigonometrical survey department of Africa would probably find it advantageous to adopt similar procedure, and, instead of trusting a base measurement to a local staff unacquainted with the work, it would send out one or two men of highly trained technical skill equipped with the best apparatus. The money spent in journeys would be more than saved—firstly, by the unquestionable gain in accuracy and the consequent avoidance of the costly necessity for repeating bad work; and, secondly, by the

gain in time, due to the fact that the local staff would not be called upon to learn the use of an unfamiliar set of instruments.

Similar advantages would arise from a partial specialization of the angular measurements. Thus the first-class observer with a theodolite must possess certain qualities of eyesight, health, and judgment, rarely combined in one individual. When such a combination of qualities is found it should be made the best use of, and a good man should not be wasted on second-class work. At present, upon the system of regarding each colony as an isolated unit, it is not possible to employ every man to the highest advantage, and there are doubtless many examples at present in Africa of able men being set tasks much below the standard of their ability and, *per contra*, men of no such qualifications being given work beyond their powers. It is only by working with an extended organization, employing a large staff, and responsible for a large area of country that any approximation can be made towards that ideal wherein every member of the establishment is used to the best advantage according to his special qualifications.

To turn from the triangulation to the question of topography, we shall find analogous arguments in favour of entrusting this work to one central department. Whether we consider the necessity for a uniform system of training for the topographer, or whether, looking at the matter from the other side, we consider the desirability of a close degree of uniformity in the resulting map, we arrive at the same end. Nor need we confine ourselves to theoretical arguments; practical results are before us as examples. It is not possible at the present moment to point out a single case of a thoroughly satisfactory topographical map of any country whatever which has not been executed by men trained in a properly organized survey department or, what is equivalent, in the Corps of Royal Engineers. Examples of failure to accomplish this are numerous. Thus we have the cases of the British Colonies in South Africa before the war; of Canada, where no topographical map existed until two years ago, when the work was taken up by the military department; and of Ceylon, where, in spite of the vast sums spent on survey and the small size of the island, no topographical map of the slightest pretensions to completeness exists of any part of the country.

It may also be noted that, especially in the case of a developing country, it is of enormous advantage that the map shall be begun and finished within some reasonable time. If a long interval elapses between the commencement and the completion, the first sheets are out of date before the last are done and the whole exhibits a most undesirable lack of uniformity.

With a central organization the mapping of each protectorate can be taken up in turn and dealt with rapidly, thus producing a homogeneous map, impossible to a small local body. Upon the converse point the question as to whether our central department should or should not undertake cadastral survey the arguments are perhaps not so one-sided. It is, however, quite clear towards which side the balance of advantage tends. Taking into account the intimate connection of the cadastral survey with the system of land holding and land taxation, the fact that these systems necessarily vary and that as a financial matter of account the receipts and expenditure of each colony are separate, it is not difficult to see that the land survey is better left to local control. This would not preclude any particular colony from arranging with the central body for the execution of any definite piece of work of this class, upon terms agreeable to both sides, in a similar manner to that in which cadastral survey is executed by the Indian survey for provincial Governments, and it need hardly be pointed out that the geodetic points fixed by triangulation would in any case be available as a framework for the large-scale map.

The geographical survey of the British Empire, apart from Africa, will not on this occasion detain us long. I exclude from present consideration the great self-governing colonies—Canada, Australia, and New Zealand—and also the whole country lying within the sphere of the survey of India. Ceylon has an elaborate land survey system; and though, owing to past mistakes, the geographical mapping of the island is in a most lamentably backward condition, there are good grounds for hope that this state of affairs will be remedied in the near future. The Malay States, where, owing to the fertility of the soil and the ubiquity of rich tin ore, the land values are high, have the basis of an excellent survey system, and possess a backbone of triangulation which will eventually extend southward to Singapore, and possibly northward to join the Indian series in the south of Burma. Hongkong, including the leased territory on the mainland, is of small area and of no appreciable geographical importance. It has been adequately mapped for military purposes. Of our insular possessions, Mauritius, St. Helena, and (in the Mediterranean) Cyprus and Malta are thoroughly surveyed. The other islands scattered throughout the ocean which fly the Union Jack, including the West Indies, while their coast-lines have naturally been the subject of close attention by the Hydrographic Department of the Admiralty, are, as regards their internal geographical features, still quite imperfectly known. The large and important territory of British Guiana is entirely unsurveyed, and indeed in part almost unexplored.

You will thus realize that if we are prepared to admit the validity of the premise that the mapping of its own territory is an imperative duty of a State which aspires to justify itself before the nations as the possessor of a world-wide Empire, there is still plenty of employment for the scientific geographer in the British dominions.

Having thus far spoken of our duties and obligations, for such they appear to me, which lie abroad in countries remote from our own shores, let us now turn our eyes inward and see if we cannot discern some similar duties lying close to our hands.

I take it that the great majority of us have been brought up in the idea that our own Ordnance Survey is of such a high order of accuracy that a proposal to undertake a revision of the fundamental triangulation of the British Isles must appear strange. Yet this idea will not be a new one to the British Association, for two years ago at the York meeting I brought the subject before this section in a short note, which gave rise to a useful discussion.

What I shall say now will be in a large measure a repetition of my previous remarks, a repetition for which I need offer no apology, as it will be apparent to you that had any steps been taken to remove this standing reproach to British geodetical science no recurrence to the subject would be called for. As matters stand, however, I feel impelled to recur to it with increased emphasis, a position in which I am confident of being supported by all those who earnestly care for the scientific repute of our country. Some few years ago, at the request of the International Geodetic Conference, a volume was prepared by General Ferrero, the eminent Italian geodesist, giving a summarized account of all the geodetic surveys of the world. If we take this volume and examine the relative degree of precision of the different national surveys there enumerated we shall find that Great Britain stands lowest on the list.

The popular illusion, for it is really no other, as to the extreme accuracy of the triangulation of the British Isles rests in no small degree upon what must be considered a fortuitous circumstance, namely, the accidental smallness of the closing error. Have we not all been told how at the conclusion of the triangulation, when the observations had been carried from the primary base on the shore of

Loch Foyle across part of Ireland and across Wales and England, terminating in two points on Salisbury plain, the distance between these points was calculated, using as data the measured length of the Loch Foyle base and the observed angles of the triangles across the country? The distance between the same two points was then measured with every refinement of accuracy, and the measured length compared with the calculated length. The difference between them was found to be 20 inches. If in traversing a large portion of the kingdom the aggregate error only amounted to this minute quantity—minute, that is, compared with the distances involved—how can we either expect or demand a better result, even if the work be redone with the most refined methods that the accumulated experience of the last fifty years can suggest?

To answer this question we must bear in mind that the closing error of a piece of work such as a triangulation is not the only, nor indeed the best, test of its precision. A small closing error may be due to accident; larger discrepancies may have occurred at intermediate stages which have chanced nearly to cancel themselves at the end. Such undoubtedly did happen in this case. The work was not as accurate as the smallness of the closing error would seem at first sight to imply. We have, however, in such a case an absolute measure of relative precision in the magnitude of the average triangular error, being the quantity by which the sum of the observed angles of a triangle exceeds or falls short of the true value of 180° + spherical excess.

From this we can readily deduce the "probable error" of a single observed angle, a form in which the measure of precision of a triangulation is often expressed.

In our British survey this quantity equals 1·20 seconds of arc, while in good modern work it does not in general exceed 0·25 second. Making due allowance for the fact that the network of triangles over our islands is a complicated one, and therefore that the ultimate precision is considerably greater than that of a chain of triangles of the same order of individual accuracy, we are probably justified in concluding that a resurvey would at least halve the final errors. Such a resurvey is urgently demanded in the interests of international geodesy.

It will, of course, be clearly understood that this implies no adverse criticism upon the work of the men who originated and carried out the primary triangulation of the British Isles. For that great achievement we must all have the most sincere admiration. It was the pioneer work of the highest order; it set a standard of accuracy never before attained, and was for long taken as the model for such work in other countries. It was, however, started at the end of the eighteenth century and was completed in 1857. It is therefore hardly surprising that it falls somewhat short of the precision of modern observations of the same class. It will also be understood that this resurvey does not affect the question of the reliability of our Ordnance Survey maps. Any errors which exist in our triangulations are important only for geodetic discussions, such as the determination of the exact figure of the Earth, and are quite negligible for map-making purposes. There can be no appreciable error from this cause upon the maps of our own country, even those on the largest scales, and no question of reconstructing our maps can arise. This is fortunate from our financial point of view. Such a reconstruction would involve a very heavy expenditure, while the cost of the retriangulation suggested would be quite trifling compared with the actual annual expense of our national surveys.

The result of this inferiority in accuracy of the British survey is that it is useless to co-ordinate it with the continental series of geodetical purposes. This defect is all the more noticeable in that the necessary observations for joining up

the two series were actually made. Three stations on the coast of Kent—St. Peter's church, between Margate and Ramsgate; Coldham, a hill about 2 miles north of Folkestone; and Fairlight, a hill about 4 miles north-east of Hastings—were connected trigonometrically with three stations in France—Montlambert; near Boulogne; St. Inglevert, over the village of Wissant; and the Clock Tower at Gravelines. This was done in 1861–3. The observations were of a high order of precision. It would not be necessary to repeat them.

The importance of the co-ordination is apparent when we inspect a map of Europe with the neighbouring part of Africa, upon which the triangulation lines are entered. We then see that the British part of the work is imperatively required to extend, and in fact to complete at one end in each case, two important geodetic arcs, viz. the meridional arc along the meridian of Greenwich and the longitudinal arc along the latitude of 52° N. Without the British portions these arcs extend from Ain Sefra in Algeria to Gravelines in France, an amplitude of 18°, and from Orsk in Russia to the same point in France, an amplitude of 57°. With the British section added they would be further extended to Saxavord, the northernmost point of the Shetland islands, and to Valentia, on the west of Ireland, respectively. The added amplitudes would be 10° and 11½°, very material additions, which would undoubtedly prove of substantial scientific value.

It will thus be seen that it is by no means necessary, or even desirable, to re-observe the whole network of triangles covering our islands. All that is required is to connect geodetically the three extreme points—Saxavord, Valentia, and the stations on the Kent coast just mentioned.

A knowledge of the exact figure of the Earth is of high scientific importance, especially so in reference to recent speculations as to its possible deviation from a spheroidal form. It cannot be other than a subject of national shame that so important a link in this research remains unfilled. We may note with gratification the forward position that our nation has in the past taken in the advancement of geodesy. We know the great work done in the triangulation of India, and we have alluded to the magnificent conception of the Cape to North Sea are due to Sir David Gill. Surely it is not asking too much that we should take steps to set our own house in order, and to ensure that our own triangulation is at least as accurate as that covering the neighbouring portions of the continent of Europe. The subject is one upon which the powerful influence of the British Association might legitimately be brought to bear, and any representations from our body would come with a peculiar appropriateness from this the Dublin meeting, seeing that so large a section of the work, whose importance we wish to urge upon the Government, lies upon Irish soil, whose execution would therefore devolve naturally on the Ordnance Survey of Ireland.

In concluding this address I feel constrained to apologize for what may have appeared to some of you the dull and unromantic character of my theme. I am too well aware that to many the idea of geographical advance is confined to the perilous traversing of virgin lands, to the navigation of unknown waters, and to the penetration of forests or deserts never yet trod by white man's feet. I am conscious that the substitution of the surveyor for the explorer has necessarily destroyed much of the old romance, and that the feelings born when any fraction of the Earth's surface was for the first time opened to our ken can never be revived. While, however, the romance has gone the dangers remain, and there is as much call now for unflinching courage and for unselfish devotion to duty as there was in the days when the search for the sources of the Nile was an impelling cause sending adventurous men into the unknown. Whether occupied in cutting his way through the almost impenetrable forests of the Gold Coast or

struggling with the papyrus swamps of the Nile basin, or whether, standing upon the top of some old volcanic hill, he is engaged in scanning the blue distances of the great Rift valley, the surveyor is not less worthy of your admiration than the earlier traveller whose name is perhaps honourably enshrined in that of river or mountain. Whether pushing his way through the jungles of the Malays or floating upon the muddy stream of an African river, whether he is braving the attacks of savage animals, of treacherous natives, or the far more insidious assaults of the germs of some deadly disease, he is equally deserving of your sympathy and your encouragement. He is in truth a shining example of the power of that spirit of adventure and thirst for information which has carried our race so far in the past, and which in the future is, we all trust, destined to lead us ever "upwards and on;" the spirit that esteems no sacrifice too great in the cause of duty, and recognizes no duty so high as that of making some contribution towards the increase of natural knowledge.

ENVIRONMENT AND RACE.*

By Prof. WILLIAM RIDGEWAY, M.A., F.B.A., Litt.D., LL.D.

LET us consider some of the chief problems which at present are being debated by the physical anthropologists. Foremost in importance of these is the stratification of populations in Europe. It has generally been held as an article of faith that Europe was first peopled by a non-Aryan race. Of course it is impossible for us to say what were the physical characteristics of palæolithic man, but when we come to neolithic man the problem becomes less hopeless. It has been generally held that the first neolithic men in Europe, whether they were descended or not from their palæolithic predecessors, had long skulls, but were not Aryan; that later on a migration of short-skulled people from Asia passed along Central Europe and into France, becoming what is commonly termed the Alpine, by some the Ligurian, by others the Celtic race; that later these two primitive non-Aryan races were overrun by the Aryans, who, when these theories were first started, were universally considered to have come from the Hindu Kush, but are now generally believed, as held by Latham, to have originated in Upper Central Europe. Yet, although the view respecting the cradle of the Aryans has changed, anthropologists have not seen the important bearing that it has upon the problem of neolithic man. The Aryans are generally held to have had a blonde complexion.

As our discussion must from its nature concern itself with questions of race, let us first examine the criteria by which anthropologists distinguish one race from another. If you ask an anthropologist how he distinguishes an Aryan from a non-Aryan race, he will tell you that he relies on three main tests: (*a*) the colour of the skin, hair, and eyes; (*b*) the shape of the skull and certain other osteological characteristics: and (*c*) the system of descent through males. Formerly language was included in the tests of race, but when it is pointed out that the Negroes of Jamaica speak English, those of Louisiana French, henceforward it was assumed that one race can embrace the language of another with the greatest ease. Yet it may turn out, after all, that language was too

* Extracts from the presidential address to the Anthropological Section ('The Application of Zoological Laws to Man'). British Association, Dublin, September 3, 1908.

hastily expelled from the criteria of race. On the other hand, we may find that too implicit faith has been placed on the three criteria of cranial characteristics, pigmentation, and law of succession.

(*a*) As it is assumed that all Aryans were blonde and traced descent through males, so it is held that all Europeans, who are dark complexioned, and whose forefathers traced descent through women, are non-Aryan in race, and that, although they now in almost every case speak an Aryan tongue, this is not their primitive speech, but simply that learned from their Aryan conquerors. According to this orthodox view, the dark-skinned inhabitants of Italy, Spain, and Greece are all non-Aryan, and all have borrowed the language of their masters, whilst of course the same is held respecting the melanochrous population of France and of the British Isles. Ever since Prof. Sergi comprehended under what he terms the "Eurafrican species" all the dark complexioned peoples of Southern and Western Europe, as well as the Semitic and Hamitic peoples of Western Asia and Northern Africa, the doctrine that the dark-skinned peoples of Europe once spoke a non-Aryan tongue or tongues is supposed to have been finally established. But under his Eurafrican species Sergi includes the blonde race of Northern Europe who speak Aryan languages along with the dark races who speak non-Aryan tongues. It is argued that as all the dark-skinned peoples on the north side of the Mediterranean belong by their physical type to the same original stock as the Semites and Hamites, they must likewise have spoken non-Aryan languages. Yet it might as well be maintained that the Finns, who speak a non-Aryan tongue, and the Scandinavians, who speak an Aryan, were originally all of one stock, because both races are blonde.

This doctrine of a Mediterranean race depends upon the tacit assumption made by the physical anthropologists that identity or similarity of type means identity of race. Yet this assumption does not bear the test of scientific examination, for it assumes that only those who are sprung from a common stock can be similar in physical structure and coloration, and it leaves altogether out of sight the effects of environment in changing racial types, and that, too, in no long time. The change in the type of the American of New England from that of his English ancestor and his approximation to the hatchet face and thin scraggy beard of the Red Indian have long been remarked, whilst the Boers of South Africa, in less than 150 years, have quite lost the old Dutch build, and become a tall weedy race. the effects of climatic conditions are very patent amongst the native peoples of the New World. The Iroquois of the temperate parts (lat. 40°–45°) of North America were a tall rather light-complexioned race, but as we keep moving south and approach the equator, their kindred tribes grow somewhat darker in complexion and more feeble in physique, except where they live at a considerable altitude, for of course altitude acts in the same way as latitude. When once we pass below the equator the physique keeps steadily improving until we come to the Pampas Indians, a vigorous race who defied all the efforts of the Spaniards to subdue them; and finally we meet the Patagonians (lat. 40°–53°), a fine, tall, light-complexioned race, who form in the south the counterpart of the Iroquois and their closely allied tribes in the north.

The same law, as is well known, can be seen at work in Europe. Starting from the Mediterranean, we meet in the lower parts a melanochrous race; but gradually, as we advance upwards, the population as a whole is growing less dark, until finally, along the shores of the Baltic, we meet the tallest and most light-complexioned race in the world. Of course it has been explained that the change in pigmentation, as we advance from south to north, is due to the varying proportions in the admixture of the blonde race of the north with the melanochrous

of the south. But it is difficult to believe that the movements up or down of the people from the southern side of the Alps, or of those from the shores of the Baltic, have been so nicely proportioned as to give the general steady change from north to south in coloration without the aid of some other force. The case of America, which I have just cited, is in itself enough to raise a suspicion that climatic influences are at work all the time, and that environment is in reality the chief factor in the variation of both stature and pigmentation from the Mediterranean to the Baltic. The white race of the north is of the same proximate ancestry as the dark-complexioned peoples of the northern shores of the Mediterranean. I have already argued elsewhere that, as the ice-sheet receded, mankind kept pressing further north, and gradually under changed climatic conditions the type changed from area to area, and they all still continued to speak the same Indo-European tongue, but with dialectic variations, these also being, no doubt, due to the physical changes in the vocal organs produced by environment.

If we turn from man to the other animals we find a complete demonstration of this doctrine. For instance, the conditions which have produced a blonde race on the Baltic have probably produced the white hare, white bears, and the tendency in the stoat and the ptarmigan to turn white in winter, whilst in the same regions of Europe and Asia the indigenous horses were of a dun colour, who not only turned white in winter, but had a great tendency to turn white altogether. It may be objected that the Lapps and Eskimo are not tall and blonde, but on the contrary short and dark; but they live within the arctic circle in regions where the sun does not shine at all for a great part of the year, and consequently they are quite outside the conditions of environment under which the tall blonde race of North Germany has long dwelt. Of course, in dealing with man we are always confronted with the difficulties arising from his migrations; but if we can find a family of lower animals who cannot be said to have thus migrated, and who show the effects of environment, we shall be able to argue powerfully from analogy.

The horse family supplies the example required. If we follow it from Northern Asia to the Cape of Good Hope, we shall find that every belt has its own particular type, changes in osteology as well as in coloration taking place from region to region. First we meet the old dun horse, with its tendency to become white, the best European examples of which were probably the now extinct ponies of the Lofoden Isles. In Asia, Prjevalsky's horse is the best living instance—a dun-coloured animal with little trace of stripes. Bordering on the Prjevalsky horse or true tarpan come the Asiatic asses—first the dzeggetai of Mongolia, a fawn-coloured animal, the under parts being Isabella-coloured; then comes the kiang of the Upper Indus valley, seldom found at a lower altitude than 10,000 feet, rufous brown with white under parts, whilst, as might be expected from its mountain habitat, its hind-quarters are much more developed in length and strength than in the asses of the plains. The *Onager indicus*, *onager*, and *hemippus* are found in all the great plains of the Punjab, Afghanistan, Western India, Baluchistan, Persia, and Syria, whilst a few are said to survive in South Arabia. All these are lighter in colour than the kiang, the typical onager being a white animal with yellow blotches on the side, neck, and head. All the Asiatic asses are distinguished by the absence of any shoulder stripe, though they occasionally show traces of stripes on the lower parts of the legs. The southern Asiatic asses just described in their greyer colour and smaller hoofs approximate to the wild asses of Africa, especially to those of Somaliland, whilst it is maintained that in their cry, as well as in their colour, the kiang and dzeggetai come closer to the horse, whose next neighbours they are.

Passing to Africa, we find the ass of Nubia and Abyssinia showing a shoulder stripe, and frequently with very strongly defined narrow stripes on the legs, the ears being longer than those of the onager. But in closer proximity to South-Western Asia comes the Somali ass, which differs from those of Nubia and Abyssinia by being greyer in colour, by the entire absence of shoulder stripes, and by smaller ears, in all which characteristics it comes closer to its neighbours on the Asiatic side than it does to its relations in Abyssinia and Nubia.

Next we meet the zebras. First comes the magnificent Grévy zebra of Somaliland, Shoa, and British East Africa. It is completely striped down to its hoofs, but the coloration of the specimens from Shoa differs from that of those from Somaliland, and from those of British East Africa. The Grévy zebra has its hoofs rounded in front like those of a horse, but its ears are more like its neighbours the asses than those of any other zebra. In the region north of the river Tana the Burchelline group of zebras overlaps the Grévy, and though it differs essentially in form, habits, and shape of its hoofs from the Grévy, some of those in the neighbourhood of Lake Barringo show gridiron markings on the croup like those on the Grévy zebra, whilst, like the latter, they also possess functional premolars. All the zebras of the equatorial regions are striped to the hoofs, but when we reach the Transvaal, the Burchelline zebra, known as Chapman's, is divesting itself of stripes on its legs, whilst the ground-colour is getting less white and the stripes less black. Further south the true Burchell zebra of the Orange river has completely lost the stripes on its legs and under-surface, its general colouring being a pale yellowish brown, the stripes being dark brown or nearly black. South of the Orange river the now extinct quagga of Cape Colony had not only begun to lose the stripes of its under part and on the hind-quarters, but in Daniell's specimen they only survived on the neck as far as the withers, the animal having its upper surface bay and a tail like that of a horse, whilst all specimens of quagga show a rounded hoof like that of a horse.

In the quagga of 30°–32° S. we have practically a bay horse corresponding to the bay Libyan horse of 30°–32° N. lat. But the production of such variations in colour do not require great differences in latitude. On the contrary, from a study of a series of skins of zebras shot for me in British East Africa, each of which is from a known locality and from a known altitude, there can be no doubt that such variations in colour are found from district to district within a comparatively small area. In addition to the two species of zebra already mentioned, there is the mountain zebra, formerly extremely common in the mountainous parts of Cape Colony and Natal, though now nearly extinct in that area. Its hind legs, as might naturally have been expected from its habitat, are more developed than those of the other zebras, just as these same limbs are also more developed in the kiang of the Himalayas than in any other ass.

With these facts before us, there can be no doubt that environment is a most potent factor not only in coloration, but also in osteology. No less certain is it that environment is capable of producing changes in animal types with great rapidity. Thus, although it is an historical fact that there were no horses in Java in 1346, and it is known that the ponies now there are descended from those brought in by the Arabs, yet within five centuries there has arisen a race of ponies (often striped) some of which are not more than 2 feet high. Darwin himself has given other examples of the rapid change in structure of horses when transferred from one environment to another, as, for instance, when Pampas horses are brought up into the Andes.

Another good example is that of the now familiar Basuto ponies. Up to 1846 the Basutos did not possess a single horse, those of them who went down and worked for the Boers of the Orange river usually taking their pay in cattle. At the date mentioned some of them began to take horses instead. These horses were of the ordinary mixed colonial kinds, and we may be sure that the Boers did not let the Basutos have picked specimens. The Basutos turned these horses out on their mountains, where, living under perfectly natural conditions, their posterity within less than forty years had settled down into a well-defined type of mountain pony.

Nor is it only in the horse family that we meet with examples of the force of environment. The tiger extends from the Indian ocean, through China up to Korea, but the tiger of Korea is a very different animal from that of Bengal. Instead of the short hair of the Indian tiger the Korean has clothed himself with a robe of dense long fur to withstand the rigours of the north. It is not unlikely that if we had a sufficient number of skins from known localities, we could trace the change in the tiger from latitude to latitude, just as I have shown in the case of the Equidæ.

Now, whilst there is certainly a general physical type common to all the peoples round the Mediterranean, it by no means follows that all those peoples are from the same original stock. On the contrary, the analogy from man in other parts of the world, as well as that of the Equidæ, suggest that the resemblance between the Berbers, who speak Hamitic, the Greeks who speak Aryan, and the Jews and Arabs who spoke Semitic, is simply due to the fact that those peoples from having long dwelt under practically similar conditions in the Mediterranean basin, have gradually acquired that physical similarity which has led Sergi to the assumption that they have a proximate common ancestry, and that they accordingly form but a single race.

Nor is there any lack of instances of convergence of type under similar conditions in the case of the lower animals. We saw that the asses of South-western Asia approximate in colour to the asses of North-east Africa, and in respect of the size of the ears and absence of shoulder-stripe, more especially to the nearest of these, the ass of Somaliland. Yet it does not follow that they are more closely related to the Somali ass than they are to their own next neighbours, the kiang. On the contrary, it is much more likely that the Somali ass is closely related to those of Abyssinia, and that the South-Western Asiatic asses are closely related to the kiang. The approximation in colour, absence of shoulder-stripe, and size of the ears between the asses of Somaliland and those of South-Western Asia must rather be explained by a convergence of types under the somewhat similar climatic conditions of Somaliland and the nearest parts of South-Western Asia. Again, though there are very strong specific differences between the Grévy and Burchelline zebras met in the neighbourhood of Lake Baringo, there is a curious approximation not only in marking but also in the teeth between these two species, which is best accounted for by supposing that it is the outcome of similar environment. It may be said that this approximation may be due to the interbreeding of the two species of zebras in the region where they overlap. This, in itself a most unlikely contingency from all that is known of the habits of wild species, certainly cannot be alleged in the case of the convergence in type between the asses of South-Western Asia and the Somali ass, since they are separated by the Red sea and the Persian gulf.

Again, the representative of the crocodile family in the Ganges is distinguished by the extreme elongation of the head and jaws, whilst the same elongation of the head is equally characteristic of the representative of the dolphin

family found in the same waters. Again, all through the Indian Ocean wherever any family of crabs have become inhabitants of coralline sands its members have long legs. Again, it has long been noticed that in Cutch all the larger animals have a tendency to become a sandy colour, whilst in certain areas of South America insects, no matter to what family they belong, have a tendency to one common aspect.

It may of course be said that the changes in colour of the horse family, tigers, and insects are for "protective" reasons. But the case of the horse family alone is sufficient to dispose of this objection. The kiang of the Himalaya had no dangerous enemy until man was armed with a rifle. In Africa the zebras have had only two formidable foes—man and the lion. Is is asserted by the most experienced hunters that the gaudy livery of the zebra makes him conspicuous from afar, whether he is on the mountain, on the plain, or in the shade of a tree. His brilliant colour therefore really exposes him to man. But it will be said that it is well adapted to conceal him at night, at which time the lion seeks his prey. Yet as the best authorities hold that the lion hunts entirely by scent, the coloration of the zebra affords him no protection against his inveterate foe.

I have shown that in horses the colours—such as bay, black, grey, and white—accompany certain well-defined inward qualities. But as black is most certainly not a primitive horse colour, it follows that coat colours may be intimately connected with certain other characteristics quite irrespective of protective colouring. Again, as the variation in the size and shape of the ears and hoofs of the asses and zebras cannot be set down to protective colouring, but must be due to other causes, there is no reason why variations in colour should not be ascribed to similar causes.

The argument based on the analogy of the horse family and the tigers, and on that of the natives of the New World, may be applied to the races of Africa. Next to the Mediterranean lie the Berbers and their Hamitic congeners, who are regarded as part of the Eurafrican species by Sergi and his school. But the Berbers are not all of the typical Mediterranean physique. The blonde Berbers of the highlands of Rif in North-West Morocco and of the Atlas have long been well known. In the region lower down and in Western Tunis the occurrence of the xanthochrous type seems much less frequent, whilst further east it practically disappears.

It is certain that there was a fair-haired element in Libya long before Rome conquered Carthage or the Vandals had passed into the ken of history. Callimachus testifies to the existence of blonde Berbers in the third century B.C. We may hold, then, with Sergi and others that the blonde element in the Berbers is not a survival from invasions of Vandals or Goths, or from Roman colonists, but that they rather owe their fair complexions and light-coloured eyes to the circumstance that they were cradled in a cool mountainous region, and not along the low-lying border of the Mediterranean like their dark-coloured relations whose language and customs they share. If, then, some of those who speak Hamitic are fair, and have been fair for centuries before Christ, as Sergi himself admits, whilst others are dark, there is no reason why some of the peoples who speak Aryan might not be dark whilst others are blonde.

The Berbers and their Hamitic congeners shade off on the south into other peoples, but this is not altogether due to intermarriage, as is commonly held, for it is more probably to be explained as due in a large part to climatic conditions. The Bantus, who are said to have originated in the Galla country and to have spread thence, are now regarded by the chief authorities as the result of an intermixture of Hamites and Negroes. But, on the grounds I have already stated,

it is more rational to regard them as having been evolved in the area lying between the Hamitic peoples on the north and the Negroes on the south, just as we have corresponding types of the horse family in Nubia and Abyssinia and in the equatorial regions. The same hypothesis also explains the existence of those cattle-keeping tribes which lie west of the Nile stretching across Northern Nigeria, who border on the Berbers, but yet differ from them, and border also on the Negroes, but differ from them likewise. South of these tribes come the Negroes, the true children of the equator. The Bantu is able to live in elevated equatorial areas, and he has burst his way down to the sub-tropical and temperate parts of south Africa, where he especially flourishes in the highlands, thus showing that his race was originally evolved under similar conditions. The Bantu found in the south the Hottentots, who are especially distinguished by steatopygy, a feature which has led some to identify them with the primitive steatopygous race supposed to have once lived in Southern Europe, Malta, and North Africa, and to have left evidence of their characteristic in their representations of themselves. But, granting that such a race once lived in North Africa and Southern Europe, there is really no more reason for supposing that they and the Hottentots formed one and the same race than there is for assuming that Daniell's quagga, which was practically a bay horse, was proximately akin to the bay horse of North Africa. The occurrence of steatopygy in two areas so wide apart is not due to an ethnical migration, but rather to similar climatic conditions producing similar characteristics.

As some anthropologists so commonly explain the origin of races such as the Bantus by intermarriage, it may be well to see whether intermarriage between two races, one of which is an invader, is likely to produce a permanent effect upon the general physique of a whole community. I have shown elsewhere that the many invasions of fair-haired races into the three southern peninsulas of Europe and into the Aegean islands have left no permanent trace on the population. It is a matter of common knowledge that the offspring of British and native parents in India have a constant tendency to die out. The same undoubtedly holds true for the offspring of British soldiers serving in Egypt, the Sudan, and West Africa. The native race always reasserts itself. In America the Spanish blood has died out, or is dying out, everywhere except in the temperate regions of Chile, Quito, and Argentina, where the descendants of the Spanish settlers thrive in a climate very analogous to that of Spain. In the Southern States of North America the whites cannot flourish, and only just manage to survive. On the other hand the descendants of the negro slaves imported into Brazil, the West Indies, and the Southern States of North America thrive and multiply with extraordinary vigour; a fact doubtless due to their race having been evolved under similar conditions in equatorial Africa.

Even from the evidence already to hand there is high probability that intermarriage can do little to form a new race unless the parents on both sides are of races evolved in similar environments.

I have already pointed out that although the fair-haired race of upper Europe has age after age kept pouring over the Alps into Italy and the other southern peninsulas, and have constantly intermixed with the indigenous populations, it is only in the upper part of Italy that the blonde race is able to hold its own. In Italy the xanthochrous race in ancient times as to-day had its maximum along the Alps, and gradually dwindled towards the south until the melanochrous race stood practically alone in the lower part of the peninsula. So too in the Balkan, whilst the fair-haired element was at its maximum along the Alps and the Danube, southwards the melanochrous becomes more and more completely dominant, as it practically is to-day in the lower part of the peninsula.

(*b*) In the Alpine regions there has been from Neolithic times a brachycephalic race, also found in central France and in the British Isles, whither it is supposed to have come in the Bronze age. It has been a fundamental article of faith with Sergi and others that this round-headed race came from Asia, the home of brachycephalism. It is Mongolian according to most, and spoke a non-Aryan language; but Sergi regards it as Aryan, thus reverting to the old doctrine, which made the Aryans come from central Asia, and he assumes that these invaders imposed their language both on the aborigines of Italy, such as the Ligurians, and on the blonde race of northern Europe; but we shall soon see that this assumption has no base. Now, as these folk dwelt in the region where we find the Ligurians of historical times, others have argued that the Ligurians were a non-Aryan people from Asia. But it is impossible to find any hard-and-fast lines between the Alpine race and the peoples north and south of it in culture and sociology. For that reason when treating of the people of the Alps in my 'Early Age of Greece' I did not take any account of the difference in cranial measurements. In 1906, at the British Association, I maintained that this difference of skull type did not mean any racial difference, and on the analogy of the changes in the osteology of the Equidæ I urged that the roundness of the skulls was simply due to environment, as the horses of the Pampas when brought up into the mountainous regions of Chile and Peru rapidly change their physical type. Physical anthropologists have already maintained that the round head of the Mongolian has been developed in the high altitude of the Altai. If that be so, there is no reason why a similar phenomenon should not have taken place in the Alpine region, in Albania, Anatolia, and wherever else in mountain areas brachycephaly has been found in more than sporadic examples, which of course may well be due to migrations or importation of slaves. But I am far from suggesting that altitude is the only cause of brachycephaly.

The evidence then, as far as it goes, points to the same conclusion as that to which we came as regards pigmentation, and it may eventually be proved that just as each area has its own type of coloration, so also has it its own osteological character. In support of this I may point out that recently Dr. William Wright, Hunterian lecturer, has come to the conclusion from his craniological investigations that the brachycephalic Alpine race was evolved on European soil, whilst Dr. C. S. Myers has been led by his researches on Egyptian skulls to conclude that, "in spite of the various infiltrations of foreign blood in the past, modern Egypt contains a homogeneous population which gradually shifts its average character as we proceed southwards from the shores of the Mediterranean to Nubia beyond the first cataract."

It is not impossible that Alpine environment may have acted upon the shape of the skull of the ox as well as that of man. We know from the examination of the fauna of the lake dwellings of Switzerland that the Celtic ox (*Bos longifrons*) was there the common type, and its descendants still continue to be the typical breed along the Alpine chain. This ox is characterized by its strongly developed occipital region and its small horns curved forward and inward. As it differs so essentially from the urus (*Bos primigenius*) and from the long-horned cattle of the Mediterranean lands, it seems not unlikely that the peculiar cranial formation may have been evolved under mountainous environment.

REVIEWS.

EUROPE.

The British Coasts.

'Royal Commission on Coast Erosion,' vol. 1 (part ii.). London: Wyman & Sons. 1907. *Price* 8*s.* 9*d.*

Much of the evidence before the Commission deals with the legal aspect of shore and foreshore rights, the desirability of establishing a central authority to deal with coast defence, the allocation of the expenses of defence works, the possibility of utilizing the unemployed upon extensive reclamation works, and other matters of little geographical interest. In addition to their verbal evidence, monographs dealing with coast erosion in general were put in by Mr. W. Whitaker and Mr. Clement Reid, together with papers by Messrs. Whitaker, Reid, Mellard Reade, and other experts, upon the sections of the coast of England and Wales of which they have personal knowledge.

Answers to certain questions were also sent in by the local authorities of all parishes possessing a seaboard. Their opinion is almost unanimous that no areas exist whose reclamation would be profitable. They differ widely as to whether any erosion can be directly traced to the removal of beach materials, some thirty answering this question in the negative, and forty in the affirmative. The explanation lies in the fact that the shingle, which is undoubtedly protective, is renewed in certain places, but not in others, by the natural drift. In Devonshire, where the pebble beaches are not derived from erosion *in situ*, and have no present recruiting ground, their removal has been particularly disastrous. The checking of the shingle drift by the construction of very high and very long groynes has also frequently led to erosion further along the shore. In one case increased erosion is traced to an order prohibiting the removal of gravel; here the destructive power of the waves was increased by the pebbles which they dashed against the cliff.

In Yorkshire, Lincolnshire, Norfolk, Suffolk, and Essex, "faggotting" the sand dunes, and planting them with marrum grass, sea-buckthorn, and tamarisk, has been very successful in checking encroachment, while in Lord Leicester's Norfolk estate, plantations of *Pinus maritima* have been employed to prevent the advance inland of blown sand.

Much difference of opinion was expressed by witnesses as to whether shingle drift is due primarily to waves or to currents; the general sense of the drift is, however, in the direction of the tidal waves. Many witnesses asserted that shingle can travel below low water mark at a depth of 10 fathoms or more, and that beaches are therefore renewable from the sea; but evidence obtained indirectly from the Marine Biological Association seems to show that no material from below 4 fathoms ever reaches the shore. The accretion of the north coast of Lincolnshire and of Dungeness is, however, cited as proving that travel at depths greater than 10 fathoms must take place.

A table of statistics, showing gains and losses of shore and foreshore during recent years, is put in by Colonel Hellard, of the Ordnance Survey Department. For the whole of the British isles the net gain above high-water line is 41,362 acres, and the net loss of foreshore 37,074 acres. These figures are not, however, quite exact, as, in the case of seventeen counties, the original surveys were made at spring tides, the later at ordinary tides. Colonel Hellard notes the erosion going on between Bridlington and Spurn Head as the most serious in the country.

The history of the defence of Southwold during the last seventy-eight years,

involving the expenditure of some £22,000 of public money, much of which has been literally thrown away, coupled with the conflicting opinions expressed by members of the Institute of Civil Engineers on many important points, shows how great is the need of further experimental research upon subjects connected with coast erosion, such as that recently undertaken by Dr. J. S. Owens.

E. T.

The Alps.

'The Alps in Nature and History.' By W. A. B. Coolidge. London: Methuen & Co. 1908. *Price 7s. 6d. net.*

On too many of the illustrated volumes which pour singly, or in series, from the modern press, the comment of the judicious reader is likely to be summarized in the old adage, "A little knowledge is a dangerous thing." They are, in fact, what painters call "potboilers," productions whose primary object is to bring in a pittance to the compiler and a profit to the publisher. Their writers, being no experts in the subjects dealt with, prefer to borrow at second or third hand from their recent predecessors rather than to consult original authorities. Lacking familiarity, personal or literary, with their theme, they are apt to fall into errors, or, if they escape these, to present facts in a novel and strangely disproportionate aspect.

No one will accuse Mr. Coolidge's work on the Alps of belonging to this class. His chief impediment in the satisfactory execution of his task has been, not too little, but too much knowledge. His qualifications are his danger, if not his defect. He has a many-sided and unique practical and literary acquaintance with the Alps and the Alpine people—geographical, historical, social. He has probably climbed and traversed more of their peaks and passes than any living man; he has lived for twelve years in their heart. Consequently his pages are a minutely tesselated pavement of facts, and some of the chapters may be found better adapted for use as a work of reference than for light reading. It would, perhaps, have been wiser to divide his overflowing material into two separate works, and to have adopted a less summary treatment in his outlines of local history. We should gladly have seen the chapters on "The Political History of the Alps" and "The Great Historical Passes" expanded to double their length, and a second volume devoted to the "Natural Aspects of the Alps and the Story of their Exploration and Conquest." But there are, no doubt, compensating advantages in having so much information condensed in a single volume, and made available by an excellent index.

The reader will find here an account of the Alps in their physical aspects, of their relationship to mankind and to their own inhabitants, of their political history, and of the many minute vicissitudes in their territorial divisions. As might be expected from an explorer so seasoned and sedulous, their groups and summits are described in detail, lists are given of the heights of the principal peaks and passes with the dates of first ascents, preceded by a brief sketch of the work done by the pioneers who opened a path to conquest for the climbers of the second half of the nineteenth century. Every page bears witness to the accumulation in the author's brain of stores of knowledge drawn from remote and rare historical sources as well as from standard works. Equally industrious as a climber and a scholar, there is hardly a glen in the Alps or a tract dealing with their story with which Mr. Coolidge is not familiar. Sitting in the centre of a well-filled library he is ready to account for irregularities of frontier, such as, for instance, those found in the Venetian Alps, or to explain the reasons for the rise and fall at various periods of the great passes.

There is no want of variety in our author's wallet. Within a few pages we

read how a great guide led him down into a crevasse, and along its bottom, where he actually saw *in situ* the rock-bed being smoothed and grooved by the fragments of harder rock carried in the ice. We are told of a feudal tenure by which the inhabitants of certain villages were bound to cover with earth a glacier in Val d'Ayas, so that the shining snow might not injure the complexions of the fair ladies of the house of Challant. We learn the variations in the legal title to glaciers in different regions. Political geography is dealt with in great detail, and the student may follow every change in the ownership of the Alpine districts, and trace the events that have given them to their present masters, in many cases causing political frontiers to diverge widely from water-partings. On such subjects what our author knows not is not knowledge. Yet we would venture to suggest that in one or two matters of detail another point of view than his may be admissible.

Mr. Coolidge, while allowing that to the Alpine people "The Alps" are the upland summer pastures (he might have added that the tops of the Tuscan Apennines are called "Alpi" from serving the same purpose), would confine the literary use of the term to the part of the range "lofty enough to bear considerable masses of perpetual snow" (p. 286). Acting on this principle, he makes the Col di Tenda —Mr. Coolidge uses the French *de* with the Italian Ten*da*—and the Radstadter Tauern the western and eastern limits of his survey. This, though we are aware that Mr. Coolidge may allege influential supporters, amongst them Brockedon and Ball, seems rather a climber's than a geographical division. We might appeal to the excellent map supplied by Mr. Bartholomew to this volume for confirmation of our preference of the Col d'Altare and the line of the railway from Linz to Leoben. We also venture to object to the exclusion of the "Alpis Maritima," the road over the neck of Turbia, from the historical passes of the Alps, and the inclusion among them of the Col di Tenda, on the simple ground that the former crosses the "main divide," while by crossing the Col di Tenda one does not pass the Alps in the ordinary sense of the phrase. Again, we find it impossible to agree with Mr. Coolidge's repeated assertion (pp. 153, 161, 163) that the Mont Cenis was in early times free from the "topographical drawback," in the case of a traveller coming from Central France, of a preliminary hill. The ordinary route to the Mont Cenis lay over one of the gaps in the Mont du Chat, above the Lake of Bourget, a passage not without difficulty before Napoleon improved the road. The alleged advantage of the Mont Cenis over the Mont Genèvre and the Col de l'Argentière in this respect is, we think, imaginary; its real advantage is in distance.

Turning to the more human side of the text, we feel that, by his decision to omit the share in Alpine exploration of all living climbers, Mr. Coolidge has left his record incomplete. He may at least claim, however—since he omits, as a rule, his own ubiquitous exploits—that he has acted impartially in this respect. An endeavour that has recently been made to assign a particular omission to a personal motive was unworthy of a serious critic.

We should add that wherever Mr. Coolidge has room to introduce the personal touch he does so with skill and effect. Witness his account of the pioneers among guides, his references to guideless mountaineering, or his sketch of the neglected Maritime Alps with their superb panoramas of sea and land, extending from the Iles d'Hyères to the Gulf of Spezzia, from Monte Rosa and the Disgrazia to Monte Cinto in Corsica; or, again, the few pages bearing the title "A Year's Round in the Alps," which describe the flowers of mid-June and the tints of October.

Mr. Yeld has contributed a very pleasant chapter on the flora of the High Alps, while Mr. Howard Knox deals with their beasts and birds. The proofs have been very carefully revised, and in the mass of local names and figures we have only

detected two trivial misprints. But may not "Mons Elvelinus" (p. 176), given as an old name for the St. Gotthard, be a misreading for "Mons Elveticus"?

The book is illustrated by admirable photographs (inserted somewhat promiscuously as regards the text) of the peaks and glaciers of the High Alps, taken mostly in unfamiliar aspects. Many of these views would serve well for an educational series of slides illustrating the phenomena of the region above the snow-level. They are a welcome variety to the vague and smudgy prettiness of the coloured plates now in fashion for book illustration. Some outline maps will help the historical student.

D. W. F.

ASIA.

High Asia.

'A Sketch of the Geography and Geology of the Himalaya Mountains and Tibet.' Parts I., II., and III. By Colonel S. G. Burrard, R.E., F.R.S., Superintendent Trigonometrical Surveys; and H. H. Hayden, B.A., F.G.S., Superintendent Geological Survey of India. *Price* 6 Rs.

The topographical features of the Earth's surface have exercised such a powerful influence on the destiny of nations and peoples, that any description of them, or attempt to explain their origin, cannot fail to be of absorbing interest. This interest is largely enhanced when descriptions are as lucid as those we find in these papers. The immense mountain ranges which form the northern and, in a lesser degree, the north-western, frontiers of India, are topographical features which have produced a marked effect on the history of this great peninsula. They have completely cut off and separated India from all communication with Central Asia towards the north, and confined it to a comparatively few well-defined routes on the north-west and north-east. Hence every conqueror, except those who came by sea, has been obliged to select one of these routes. But apart from any historic influence the Himalaya ranges may have had, they are, in themselves, full of interest. The grand scale on which these mountains are built, their immense height and inaccessibility, all tend to inflame the imagination and excite curiosity.

The papers before us are divided into three parts dealing chiefly with the geography of the region, while a fourth part, not yet published, is to be devoted exclusively to geology. Questions relating to geography and geodesy are dealt with by Colonel Burrard, while the geological portions are by Mr. H. H. Hayden.

In Part I. Colonel Burrard discusses at length the heights of the great peaks, the errors the published determinations are liable to, and the difficulties which beset the surveyor in the measurement of the heights of inaccessible objects, owing to the many uncertainties inseparable from the operation. He has classified under five groups seventy-five great peaks, which attain a height of 24,000 feet and over. He considers and deduces reasons for supposing that "there is little probability now of a higher peak than Mount Everest being discovered, and even the prospect of finding a new peak of 27,000 or 26,000 feet is becoming remote." Though Mount Everest is the highest mountain in the world, perhaps Nanga Parbat, in the Punjab Himalaya, is the most imposing. It attains a height of 26,620 feet, 23,120 of which are exposed to the eye of the observer. It is, as Colonel Tanner remarks, "one of the grandest spectacles nature offers to the gaze of man."

A very interesting and scientifically treated section is devoted to the errors of the adopted values of heights. The principal sources of error are due to deviation of gravity or local attraction of the range, which affects the datum from which altitudes are measured, and the difficulty of determining the correct coefficient of refraction suitable for rays traversing extreme varieties of atmospheric

conditions in passing over great distances. The latter produces the greater effect on the results. In the case of Mount Everest, which has been worked out in detail, it would appear that when the station of observation is situated in the hills a coefficient of 0·05, and when in the plains 0·0645, gives the best results. From these Colonel Burrard deduces the most probable value for the height of Mount Everest as 29,141 feet, or 139 feet greater than the accepted value of 29,002. No doubt the higher value would have been adopted had we known as much about refraction when it was first measured as we do now. The latest value, however, omits the effect of the deviation of gravity (which might make the mountain some 60 feet higher), of which our knowledge is as yet imperfect. The method adopted of treating the question of refraction is certainly most interesting, and might with advantage be applied to the computations of future heights where reciprocal angles cannot be measured. It is to be hoped that opportunities will arise, and facilities be given, for extending our knowledge of local attraction by observations over as large an area as possible. We shall then be in a position to compute its effect on apparent angles of elevation.

The last section of this part is on the geology of the great peaks by Mr. Hayden. As far as can be ascertained they are composed of granite, gneiss, and associated crystalline rocks. Specimens of these rocks are fairly common in the beds of some of the great Himalayan rivers; they have even, in the case of the Jumna, been carried as far as the plains. Though for want of positive knowledge it is not quite certain that all the great peaks are composed of granite, yet such widely separated mountains as Kichinjunga and Nanga Parbat are known to be so. Indeed, it is probable that the groups of high peaks are situated on a more or less continuous axis of granitic material, which during the development of the Himalaya as a mighty mountain range "welled up from below, forcing its way through, and lifting up, the pre-existing rocks." It is probable that their present great height is largely due to the power of the material of which they are composed to resist weathering, especially when it is protected by a mantle of everlasting snow.

Part II., dealing with the principal mountain ranges of Asia, opens with an article by Mr. Hayden, on the origin of mountain ranges. They appear to have been formed by a great horizontal thrust in the earth's crust coming from the north. Many theories have been advanced to explain this complex subject. The author selects three hypotheses as the most important—(1) Contraction of the Earth; (2) disturbance of isostasy; (3) change of the rate of the Earth's rotation. It may, perhaps, be that mountain ranges are produced by a combination of all these causes, which may have been slowly at work through countless ages, and probably still are in operation.

The question of local attraction causing the deviation of the plumb-line, which has already been referred to, is dealt with in more detail in the next section by Colonel Burrard. It has been known for some time that the attractive effect of the Himalaya diminishes much more rapidly, as the plains of India are entered in a southerly direction, than can be accounted for on purely theoretical considerations. For instance, the northerly deflection at Dehra Dun is 37″, while it is almost zero at Kaliana, situated in the plains 55 miles to the south. On a basis of 37″ at Dehra Dun, there should be, theoretically, a deflection of 18″ at Kaliana. Though the matter had been dealt with by Archdeacon Pratt we believe Colonel Burrard is the first to explain, in a satisfactory manner, the cause of this divergence of theory from practice. It can be explained by supposing the existence, south of Kaliana, of a chain of very dense material almost parallel to the Himalaya, buried in the earth's crust, the attraction of which produces a deviation in the opposite direction to that of the visible mountains. At Kaliana these two attractions are almost equal and

in opposite directions. Major Lennox Conyngham's pendulum observations have confirmed the existence of this dense mass, originally suggested by the known deviations of the plumb-line.

To the map-maker the question of how best to show mountain ranges where great differences of height occur, is one of the utmost importance. Perhaps a solution of this problem is to be found in the employment of the layer system of representing heights by different colour tints. If the colour scale be suitably selected, this method can be made to give most effective results. It also has the advantage of leaving nothing to the imagination of the draftsman.

Part III. is devoted to a detailed description of the rivers of the Himalaya and Tibet, with, in many instances, an historical sketch of their exploration. This is interesting as showing the curious mistakes made by early explorers, as in the case of the source of the Ganges. But such mistakes are perhaps excusable when one considers the hopeless entanglement these mountains must have presented to the traveller before the days of maps. One thing strikes the reader that, notwithstanding the area already mapped and explored, there still remain large tracts the topography of which is uncertain. There is yet work here for the Survey of India, and for the enterprising traveller.

Many of the Himalayan rivers have such steep gradients that there must be immense water power, comparatively close to the densely populated plains of India. These still await investigation with a view to determining how far they could be used for the transmission of electrical power for economic purposes. This is a matter in which the Government of India might, with advantage, follow the example of the United States, where natural sources of power are officially investigated.

Systematic measurements have recently been begun, at the request of the International Committee for the Study of Glaciers, by the Geological Survey of several glaciers in different districts, to determine glacial movements of advance and retreat. Marks have been laid down, plans made, and photographs taken of the state of affairs at the date of observation. It is hoped that travellers and sportsmen visiting the glaciers will assist in this work. Information on the subject can be obtained from the Director, Geological Survey, Calcutta.

We must refer the student who wishes to study this interesting area to the papers themselves. An immense amount of literature has been consulted in their preparation. They are profusely illustrated by charts and plans. The papers are published by order of the Indian Government.

H. L. C.

Two Guides to Ceylon.

'The Book of Ceylon.' By Henry W. Cave. London: Cassell. 1908. Pp. xiv. and 664. *Maps and Illustrations. Price* 12*s. net.*

'Ceylon: A Handbook for the Resident and the Traveller.' By J. C. Willis. Colombo: Colombo Apothecaries Co.; London: Dulau. 1907. Pp. x. (unnumbered), 247, and iv. *Maps and Illustrations.*

Each of these books is of a character which should ensure a welcome from geographers, and particularly from those interested in the geography of the Empire, for there are not too many such works on its component parts. Mr. Cave's name is already well known in connection with books concerning the island from particular points of view. In 'Golden Tips' he dealt mainly with the tea industry; in 'The Ruined Cities of Ceylon' with a very different subject; in fact, his varied interests prove him to be well equipped for the production of such a work

on the island as that now before us—"an account of its varied attractions for the visitor and tourist," to quote the sub-title. The reader will find that he is first introduced to the geography, climate, and history of Ceylon in general terms, and the system of government is briefly touched upon. He is then led through the island in various directions, the railway lines providing the groundwork for the routes. The descriptions of every site and scene of interest are clear and concise, while avoiding that concentration in style typical of the ordinary guide-book, which makes against literary pretensions. Marginal headings afford a running analysis of the paragraphs. This is a useful feature; but the index does not appear to be satisfactory; at any rate, there is a certain number of entries in it of that usual but valueless type which does not represent a subject which a reader could be expected to look up. There is a short but valuable appendix of information necessary to visitors. But perhaps the most notable feature of the book is the vast number of photographic illustrations. These interleave every page of text, and are often very beautiful, and always finely reproduced, though a few suffer from being reduced too small for their subjects. There is one other objection to them: the heavy paper on which they must be printed makes the book irksome to hold.

Mr. Willis's book would be that chosen, of the two, as an introduction to a serious geographical study of Ceylon. In style and arrangement it is laid out on somewhat more formal lines, the whole work being divided by subjects, not "according to itineraries." The first part deals with geology and geography, products, climate, zoology, botany, agriculture, and forests (on which the author, as director of the royal botanical garden at Peradeniya, writes with more than usual authority). We have next history, ethnology, and archæology, then a descriptive section, including an alphabetical gazetteer of chief towns, villages, etc., excellently carried out in a small compass, a section on sport, and a miscellaneous section, including a glossary and biblography. This brief synopsis shows the book to be a true work of general reference for Ceylon, and, being fairly mapped and illustrated, it could hardly be improved upon in design.

AFRICA.

Cyrenaica.

'Cirene e Cartagini.' By G. de Martino. *Illustrated.* Pp. 193. Bologna: Zanichelli. 1908. *Price* 6*s.*

If this prettily illustrated book cannot be said to add much to our geographical knowledge, it is welcome for more than one reason. It gives an *interim* report on the actual political state of the strangely inaccessible Cyrenaic region, and throws a good deal of light on the policy by which Italy, the most interested of the European powers, proposes to reduce that inaccessibility. It therefore bears directly on the future of geographical exploration in a hardly known corner of Africa. Signor de Martino, a senator of the Kingdom of Italy and president of the Italian Colonial Institute, made his way from Derna to Bengazi by the usual overland route, with a *détour* from Guba to Marsa Susa. He was wise to enter at the back door, so to speak, for, had he gone round to the front, *i.e.* to Bengazi, he would almost certainly have got no further inland. Even as it was he had to use guile, and pose as a travelling buyer of skins—the trade of his two companions, Italian residents at Derna. It would have been better had he prepared himself for the trip by getting up the literature of previous travel—he shows either very inaccurate knowledge or no knowledge at all of his immediate European predecessors—but he could use his eyes, and he looked sanely and thoroughly at what he saw. It would seem as if Ottoman rule in Cyrenaica had experienced somewhat of a set back of late. Signor

de Martino found its effective control limited to a few garrisoned ports and the rest of the country defiant. At Cyrene itself he was treated with suspicion, and strongly advised to make himself scarce; but he came to no harm, his companions being favourably known to the tribes. He saw great possibilities in the country, but an actual state of deplorable neglect and disafforestation. Of places where the Ottoman rule prevails he gives a bad account. But he deprecates Italian political interference, and recommends a policy of peaceful penetration. By the way, he states some curious facts about Egyptian action in this region: the frontier seems singularly indefinite. On a possible future for the port of Tebruk he rightly insists.

The part of his book devoted to Tripoli and Tunisia is of less interest, and very superficial. He uses the little he saw of this latter country chiefly as an ensample to his countrymen. If France can do what she has done in the old territory of Carthage, why not Italy in that of Cyrene? But this is hardly consistent with peaceful penetration!

D. G. H.

AMERICA.

The History of the Niagara Falls.

J. W. W. Spencer. "The Falls of Niagara, Their Evolution and Varying Relations to the Great Lakes; Characteristics of the Power and the Effects of its Diversion." Geological Survey of Canada. Ottawa, 1907, xxxi. + 490 pp. *Plates and Maps.*

The written history of Niagara dates from the visit of Hennepin in 1678. The position of the falls at that date can be inferred from his description, and the rate at which the falls have been cut backward during the past 230 years can therefore be determined. Niagara, accordingly, is an instructive example of the rate of river erosion, and, as the falls must have come into being at the end of the glacial period, they supply a means of estimating the length in years of post-glacial time, for the locality of Niagara. The first important estimate was that by Lyell, in 1835, who assigned Niagara a part-life of 35,000 years. The date has since been re-calculated several times, by geologists with much fuller data than were available to Lyell. The problem does not admit of simple solution, owing to the complexity of the physical geography of the country and its river system. Lyell explained the whirlpool below the Niagara rapids as due to a former river channel, now filled by soft drifts, which are more easily worn away than the harder rocks of the old river banks. The presence of such an ancient gorge along the present course of the river would have so greatly facilitated the formation of the existing canyon that Lyell's estimate of the time necessary may be greatly reduced.

Modern studies of the geology of the area have continually added to the complexity of the problem, and the Geological Survey of Canada is to be congratulated on the important monograph by Dr. Spencer, in which he summarizes the available evidence, and makes several important additions to the known facts. The new information in this work includes the results of a series of borings, as originally suggested by Prof. H. S. Williams, to determine the cause of the buried river channel exposed at the whirlpool. The second important contribution is the survey of the Niagara river below the falls, by a course of difficult and dangerous soundings. This work has shown the existence, immediately below the falls, of a basin 192 feet deep. Further down-stream, at the cantilever bridge, the channel shallows to only 86 feet, owing to the accumulation of limestone boulders that have fallen into the river from the sides of the gorge. When the falls were at that position the depth of the river channel below them was as deep as it now is further up-stream.

The rate of recession of the falls is now well established. The retreat has been

proved by careful surveys between 1842 and 1905, and the mean retreat during those 63 years has been 4·2 feet per annum, while 7¾ acres of the river channel above the falls has been worn away during that period.

Lyell's estimate has been reduced until Dr. G. K. Gilbert allows the falls a past life of only 7000 years, and a future of some 3500 or 5000 years. This prediction is based on the assumed tilting of the area of the great lakes, which would, if continued, divert the drainage from the St. Lawrence into the Mississippi. Dr. Spencer rejects both Gilbert's conclusions. He even exceeds Lyell's estimate, as he assigns the falls a past of 39,000 years, and promises them a long future unless all their water be diverted for the sake of electric power. The factors that add to the antiquity of Niagara include the great increase in the height of the falls and in the volume of the water. At first the Niagara river plunged directly into Lake Ontario, as that lake was then standing at the level of its highest beaches; the falls were only 35 feet high. Moreover, the volume of the river was only 15 per cent. of the present amount, for at that time the drainage of the great lakes was discharged from Lake Huron into the valley of the Ottawa river. Earth-movements closed this outlet, and for a while the great lakes overflowed from Lake Michigan across the divide near Chicago into the Mississippi, and at another time their outlet was from the southern end of Lake Huron into Lake Ontario. Finally, during these complicated changes in the river systems, Lake Huron flooded the valley which is now occupied by Lake St. Clair and the Detroit river, and reversing the direction of the rivers there, overflowed into Lake Erie. The Niagara river thus received all the waters discharged by the great lakes, except Lake Ontario.

The history of the Niagara river is, therefore, unusually complex, but Dr. Spencer has the most engaging faith in the certainty of his estimates. He calculates that the falls were opposite the whirlpool 3000 years ago, and the overflow from Lake Michigan into the Mississippi happened from 2000 to 2500 years since.

Another important geographical problem connected with the Niagara question is the still-continued tilting of the area around the great lakes, which, according to Dr. G. K. Gilbert, is still in progress, and will drain Niagara some 3000 years hence. Dr. Spencer, however, maintains that the area in question is quite stable, and that it has not moved in recent times. The earth-movements in this region were confined to the north-east of Lake Ontario, and the supposed recent changes in the shores of Lake Michigan he attributes to local meteorological causes. Dr. Spencer discusses whether the admitted tilting to the north-east of the great lakes be an isostatic effect due to the retreat of the ice; he, however, rejects this view, and prefers the explanation of the Rev. O. Fisher that the movement was caused by a flow of material in the fluid sub-stratum of the Earth.

The Geological Survey of Canada is to be congratulated on this valuable contribution to an important geographical question, but we regret that such a work should have been made the medium for a series of accusations against one of the most distinguished of American geographers.

GENERAL.

Ethnography.

'The World's Peoples: A popular account of their bodily and mental characters, beliefs, traditions, political and social institutions.' By A. H. Keane, LL.D., F.R.A.I. London: Hutchinson. 1908. 8 × 5, pp. 429. Price 6s.

Dr. Keane's work as an anthropologist is well known and justly valued, and he has done good service to the science in writing this popular account of the peoples of the world, the price of which should put it well within the reach of every one,

and it should serve to stimulate an interest in this, the most fascinating of all the sciences.

After an introductory chapter on the human family, in which the theories of monogenesis and polygenesis are discussed, and a general sketch setting out the general characters of the different peoples, Dr. Keane proceeds to deal with each division separately. Thus, there are chapters on the Oceanic Negros and Negritos, the African Negros and Negritos, the Mongols, the Amerindians, and the Caucasic or White division, in which the author places the Polynesians, which many anthropologists consider open to grave doubt, or at least not proven. In each section, besides a description of the physical characters of the people, which is wisely brief, Dr. Keane gives an account of their religion, folklore, and institutions.

A great feature has been made of the illustrations, which are all taken from photographs and show a marked advance on those figuring in other works of a similar nature. They more than adequately illustrate the text, and are alone worth the price asked for the book. But where the illustrations are so good it is a pity that the publishers could not have seen their way to add a few maps. These, if only in outline, would have been a great help to the reader, who has not always an atlas handy, and where he has, would not find a tithe of the tribes marked. It would also be an advantage if, in subsequent editions, short bibliographies of the more important works could be added at the end of each section.

The size of the book naturally necessitates that it should be merely a sketch (details cannot be entered into in four hundred pages, about a third of which is taken up with pictures), but should it inspire its readers to go more fully into the subject, as it surely should, it will have more than done its work.

SHORT NOTICES.

Europe.—'The Land's End.' By W. H. Hudson. (London: Hutchinson. 1908. Pp. viii., 323. *Illustrations.* 10*s.* 6*d. net.*) For a book so strictly local and personal in interest this is something lacking in distinction of style or matter. But that is not to deny that it forms very pleasant reading, and will interest the many lovers of Cornwall, particularly as it gives impressions of the western peninsula in winter, a season when it is not known to most of them. The topographical interest, however, is subordinate to that of the naturalist, the book dealing primarily with the habits of birds. The wash and line drawings by Mr. A. L. Collins are executed with taste, and well reproduced.

'Through Finland to St. Petersburg.' By A. Maccallum Scott. (London: Grant Richards. 1908. Pp. x., 287. *Map and Illustr.* 2*s.* 6*d. net.*) This is a very successful attempt to combine the value of a guide to travellers with literary attraction. Its descriptions are clearly phrased; its photographs in most cases beautiful. It deals with the more frequented parts of a country which has attracted much recent attention for political reasons, and is probably visited by an increasing number of tourists; for it is difficult to follow the author in his assertion that "the average British reader still . . . thinks of [Finland] as a snowy waste where the few fur-clad inhabitants contrive to prolong their existence on whale blubber." In fact, the first paragraph of the preface (from which the above words are quoted) is the only obvious flaw in the book, save that the map is supremely oblivious of orthography.

'Castles and Chateaux of Old Navarre.' By Francis Miltoun. (London: Pitman. 1908. Pp. xvii., 456. *Maps and Illustrations.* 7*s.* 6*d.*) The writer ranges both sides of the Pyrenees, covering, according to the sub-title, the Basque Provinces, Foix, Roussillon, and Béarn. The text shows not only literary ability, but erudition in many directions, so as to make the book of much higher value than a mere

record of impressions. This was indeed to be expected from the writer's previous works of the same character. The book is excellently produced at the price. The illustrations suffer in some instances from an exaggerated style of colour and representation of topographical features, but where they are free of this fault they are admirable. The book may be commended alike to those who know the Pyrenees and those who intend to do so.

'Through Savage Europe.' By Harry De Windt. (London: Fisher Unwin. 1908. Pp. 300. *Illustrations.* 10*s.* 6*d. net.*) The author bases this book on travels through the Balkan States and European Russia. The title indicates a certain tendency towards the sensational, and the book is not wholly free of the same tone. It is interesting for leisure reading, and though it is without distinction on the whole, full justice is done to those points of interest which would most readily strike the traveller in Mr. de Windt's path. Among many excellent photographs, special notice may be taken of several fine bird's-eye views of towns visited.

'The Early History of the Levant Company.' By M. Epstein. (London: Routledge. 1908. Pp. x. and 270. 2*s.* 6*d. net.*) This is a very interesting compilation, tracing the history of the Company from its first incorporation in 1592 down to 1640, and also dealing with the circumstances and the earlier companies which preceded its foundation. Material hitherto unprinted has been largely drawn on, and is moreover quoted at length, and in arrangement and the careful method of reference to authorities the book gives every evidence of scholarly work. It might with advantage have been briefly indexed.

Asia.—'Persia: the Awakening East.' By W. P. Cresson. (Philadelphia: Lippincott. 1908. Pp. 275. *Illustrations.* $3.50 *net.*) The internal political circumstances of Persia have been lately in such rapid motion that it is already necessary to read Mr. Cresson's experiences (from this aspect) in a new light. This, in a sense, detracts from their interest, and, on the other hand, the awakening of Persia has not yet brought the country to the point of development when it begins to possess new geographical interests apart from the work of actual exploration. This book has, perhaps, therefore, been written at an unfortunate moment, but it is well written.

THE MONTHLY RECORD.

EUROPE.

Temperature and Altitude in Switzerland.—The vertical distribution of temperature in the Eastern Alps was dealt with in a masterly manner by Dr. J. Hann some twenty years ago, but a similar study for the Swiss Alps as a whole has hitherto been a desideratum. It has lately been undertaken by Dr. J. Maurer, director of the Swiss Meteorological Office, who has given the broad results, with a brief indication of the methods adopted, in the June number of the *Meteorologische Zeitschrift* for 1908. In order to supply a basis of comparison with Dr. Hann's results, Dr. Maurer has, like the latter, combined the various series of temperature means available for the purpose by the method of least squares, arranging the data in groups corresponding with the main climatic regions into which the Swiss Alps may be divided. The results are shown in a table, in which the decrease in temperature for every 100 metres is given for each month of the year in the several climatic regions (Jura, Northern Slope of the Alps, Eastern Swiss Alps, Southern Slope, Valais). Another table shows the general results obtained by Hann for the eastern Alps side by side with Dr. Maurer's figures, a comparison

being in each case made between the northern and southern slopes of the range; and the general agreement is most satisfactory. On the northern slope, the mean yearly decrease per 100 metres works out as 0·507° C. (0·907° Fahr.) in the case of the Eastern, and as 0·510° in the case of the Swiss Alps. Dr. Maurer proceeds to compare the observed with the calculated temperatures for the various levels in Northern and Southern Switzerland and in the Valais respectively, with instructive results. In Northern Switzerland the actual temperatures from 900 to 1300 metres appear throughout too warm, and in spring and summer this excess reaches up to 1700 metres. In the south these conditions come out still more markedly for all the seasons. Lastly, special instances are given of exceptional local deviations of the actual from the theoretical temperatures, the cases of most marked excess of the former occurring in the Föhn districts on the northern side and at stations with specially warm exposures.

Sebastian Münster's Map of Germany of 1525.—In *Globus* (vol. 94, No. 1) is to be found, along with a descriptive article on the subject by Dr. A. Wolkenhauer, an excellent photographic reproduction, half size, of Sebastian Münster's long-missing map of Germany published in 1525. Among the maps of Germany most widely circulated in the sixteenth century was Münster's woodcut map, included from 1540 in his editions of Ptolemy, and from 1544 in the very numerous editions of his 'Cosmographia.' Till recently, however, there was lost to geography the considerably better single map of Germany above referred to, constituting the main part of Münster's 'Instrument der Sonnen' published in 1525. The popularity of this latter map is witnessed by the fact that an explanatory booklet went through many editions, a new and somewhat altered impression appearing in 1579. At length, after having been so long sought after, a copy was in 1907 produced at the sixteenth German Geographentag at Nuremberg—a coloured woodcut, 28 by 17½ inches, containing, besides the map in its centre, astronomical figures and a table of places. The sheet is entitled 'Eyn New lüstig und kurzweilig Instrument der Sonnen, mit yngesetzter Landtafel Teütscher nation," and is dedicated to Graf Georg of Wertheim. The above-mentioned booklet, now rare, was published at Oppenheim in 1528. The sheet exhibited—the only known copy at the time—is the property of the Nuremberg Library. Since then, however, Dr. Wolkenhauer has made acquaintance with a second copy belonging to the Basel University Library, and from this copy the photographic reproduction is taken. The second part of the explanatory booklet earnestly invites special maps and reports, in order to the production of a full description of Germany planned by Münster. It recommends also the cartographic delineation of the environs of towns as illustrated by a map of the environs of Heidelberg. Besides the circular map in the centre of the sheet, there are four corner circles of astronomic or astrological import, called for by the fashion of the times, and entitled—(1) diurnal, (2) nocturnal, (3) circle of date, (4) circle of rising signs. Flanking the plate to right and to left are diagrams of solar eclipses, etc. Dr. Wolkenhauer makes some interesting remarks on the sources and contents of the map, which is the earliest map of Germany to show the course of the Rhine with an approach to accuracy. He has lately unearthed in the Munich library a manuscript notebook of Münster's, dating from 1515, which, besides copies of other maps of Germany, contains sketches of the course of the Rhine.

The Southern Carpathians.—We have already referred briefly to Prof. de Martonne's monograph on the Southern Carpathians, published in vol. 1 of the new series of the *Revue de Géographie*. A somewhat fuller analysis may be given here. The main problems considered are (1) the abrupt changes of direction of the Carpathians; (2) the peculiar aspect of the Carpathian summits; (3) the character

of the Oltenian depressions; (4) the transverse courses of the Jiu and Oltu; (5) the glaciation of the Carpathians. The first problem disappears when we consider that the history of the regions west and east of the Prahova is entirely different. To the west of this river the predominant forms are two series of metamorphosed Palæozoic schists, accompanied by eruptive rocks and Mesozoic limestones, some of which are also metamorphosed. The whole region was vigorously folded and dislocated during Mesozoic times, as is shown by the fact that the Palæozoic schists overlie the Mesozoic. Its subsequent movements have been entirely epeirogenic, with the exception of local folding and faulting in the Tertiary basins. In this region the lines of relief are in striking discord with the structural and tectonic features. East of the Prahova the chief formations are cretaceous and Palæogenic flysch, with molasse. The region was folded regularly in Tertiary times, and forms a mountain system of the Jura type, in which relief and structure are harmonious. The Carpathian summits, especially in the Banat and Transylvanian massifs, whether formed of limestone, granite, or schist, are strikingly uniform in their general appearance, which is that of advanced maturity; in this they contrast with the valleys, which display all the characteristics of youth. These summits form a platform of a general level of 1800–2000 metres, which is clearly an old uplifted peneplain. The author calls it the Boresco platform, after the district in which it is best developed; he assigns it probably to the Upper Cretaceous. An examination of the relief showed the remains of a second platform, that of Riu Ses, which had reached maturity during the Miocene, and a third, that of Gornovitza, active erosion of which is still going on. The Riu Ses platform underwent considerable warping and flexure, and its general level is not constant; the Gornovitza platform averages 400–800 metres, except in the Petrosheni basin, while its altitude is 900–1100 metres. Thus the region has been subjected to a series of uplifts *en masse*, and during the successive cycles of erosion all relation between relief and structure has been destroyed. A series of basins aligned from west to east lies between the Southern Carpathians and the Valakhian hills. These are formed by a synclinal fold, and their general correspondence with the extent of the calciferous deposits of the second Mediterranean stage shows them to have been already sketched out in the Miocene. At the end of the Pliocene they attained maturity, forming part of the Gornovitza platform; their drainage was then longitudinal; subsequent orogenic movements caused the capture of their streams by the headwaters of the rivers of the southern hills. Maturity was again reached, but still later movements during the pleistocene caused an uplift of the whole sub-Carpathian region with the exception of the depression west of the Gilortu, *i.e.* Tismana and Targu Jiu. The Mehidintzi and Miroci plateaux lying respectively north and south of the Danube gorge are one from the point of view of both structure and relief, forming part of the Gornovitza platform; thus the theory of a fracture opening a path for the river is untenable, since the gorge is Quaternary, and all dislocations had been effaced by Tertiary erosion. The problem cannot be studied apart from the history of the Alföld lake; the erosion of deposits of conglomerates at the mouth of the gorge, and traces of violent erosion below Turnu Severin, would correspond to a sudden emptying of this lake; while the deep cauldron of Kazan suggests a recent waterfall bursting probably from a cavern in the tithonic limestone with all the force of a subterranean stream. The lack of accord between the tributaries entering the gorge and the main stream is important. The transverse courses of the Jiu and the Oltu (Alt) are both ascribed to capture. The Surduc gorge of the Jiu is obviously young; its terraces are all Pleistocene, and correspond to those of the Petrosheni basin. It is seen to be cut down into the floor of an old Pliocene valley, and at a higher level the Riu Ses platform is traceable. A deposit

of detritus, which includes fragments of crystalline schist, lies on the present Jiu-Streiu divide, hence an old and vigorous river must once have flowed over this sill. The general level of the Riu Ses platform shows that the Mio-pliocene drainage was towards the north. A post-Pliocene uplift of the Petrosheni basin, coupled with the exceptionally low level of the Targu Jiu depression, determined the reversal of the direction of drainage. The Hatzeg basin is shown to have been at a higher level during the Pliocene than the Targu Jiu depression; its Tertiary beds were probably not powerfully eroded until the disappearance of the Alföld lake during the Quaternary. With regard to the Oltu, a study of the relief above the gorge, and of the striking discord between the rivers Baiasi and Gressilor and the structural lines, shows that the region of the Roteturm gorge drained north before the Pliocene. The southward drainage dates from the end of this epoch; it was prepared for by the levelling of the Brezoiu-Titesci region, together with the lowering of the divide, which was facilitated by the extent of the flysch. The decisive events were the gradual sinking of lower Muntenia, which has continued right through the Quaternary, coupled with an uplift of Transylvania, including the Haromszeg and Fogarash basins, in harmony with the general south Carpathian post-Pliocene uplift. The evidence for the glaciation of the Southern Carpathians is complete, none of the characteristic glacial forms being absent, but cirques are the most characteristic feature. These are most numerous in the Banat massif and in the mountains of Fogarash, where the Boresco platform had its greatest development; the glaciers rarely extended into the valleys. Their predominant easterly orientation is due to the fact that the most abundant precipitation accompanied the easterly winds. The lower limit of perpetual snow is placed at 1900 metres, and during a possible second glaciation at 2100 metres. The result of the glaciation has been to give an alpine character to some of the summits, especially those of Fogarash.

ASIA.

Dr. Sven Hedin's Return.—Dr. Sven Hedin has returned to India from his latest Tibetan Expedition, the latter stages of which have been as fruitful as the earlier in geographical results. It will be remembered that after reaching Gartok in the autumn of 1907 (*Journal*, vol. **31**, pp. 216, 333), the traveller announced his intention of starting for Ladakh and Khotan. From a narrative of his subsequent journey communicated by Dr. Hedin to the *Times* of September 17 and 18, it appears that the mention of Khotan was intended to throw the Tibetans off the scent, for after organizing a fresh caravan at Leh, and making a northward start, he turned sharp to the east when two marches short of the Karakoram pass, in order to continue his work in South-Western Tibet. The narrative alluded to is too vague to permit the route to be followed throughout, but it is stated that the Aksai-chin was reached in January, 1908, the caravan suffering severely from constant snowstorms. On January 15 a temperature of −39°·8 C. (−39°·6 Fahr.) was registered. Dr. Hedin's feet were partly frozen, and all the sheep taken for food died. Eventually the party reached the Shementso—which is shown as in 34° N., 81½° E., in the maps of Captains Deasy and Rawling (*Journal*, November, 1900, and April, 1905)—and, continuing the march to the south-east, passed the Lemchang lake (Lenchung-cho of Deasy). Goldfields were seen on this section of the route, but they were deserted for the winter. Dr. Hedin now disguised his nationality and concealed his instruments in bags of rice, travelling as a common Ladakhi and posing as the servant of his caravan-bashi, Abdul Karim. Frequent suspicion was, however, aroused, while the difficulties of the march were increased by constant south-west storms. At Tong-tso, just

north of 32°, the routes of Nain Singh, Littledale, and Dr. Hedin's own route of 1901 were crossed, and the unknown tract between 32° and 30° was soon entered. The party marched due south, crossing several ranges running east and west, and obtaining food from the nomads. Beyond the Ladang pass, the hitherto unvisited province of Bongba was entered. After obtaining news of the great salt lake of Tabia Tsaka (the salt from which is a source of considerable wealth to the Government) and crossing two more ranges, Dr. Hedin once more reached the great range which bounds the Brahmaputra valley to the north. Its continuity—to test which was one of the main objects of the trip—was established, and the range was crossed for the eighth time by the Samyela pass, 18,000 feet high. The traveller now explored the course of the Charta-tsangpo, which is fed from huge snowpeaks and traverses a lake. At last, apparently in the neighbourhood of the Brahmaputra valley, his disguise was penetrated; but by showing a firm front, he effected a compromise with the authorities, the caravan being split up into two parts, with one of which, accompanied by an armed escort, he returned to the Bongba province. Crossing a pass of 19,000 feet in the great range, he reached the Tedenam-tso, heard of by Nain Singh in 1873, but of which the real name is Terenam. It proved to be long, narrow, and salt.* Turning westward, he visited the Mending temple on the Soma Tsangpo, the largest Tibetan river without access to the ocean. Khala (shown on the Society's map as a peak) is really a pass in a high range branching off from the main system. Ghalaring-tso, described on the same map as containing a monastery on an island, was next visited. Its name should be Ngnanglaring-tso, and there are five islands. Finally, after crossing the great northern range for the tenth time, the traveller reached Manasarowar on July 26, and made his way by known routes to Simla. By his latest journeys Dr. Hedin has added to his previous achievements the exploration of the most important hitherto unknown part of Tibet; and his detailed examination of the great northern range, which, from the time of Brian Hodgson onwards, has been shown more or less hypothetically in our maps, is a service to geography which may well rank with any of the traveller's previous discoveries.

Coast Features of Ceylon.—We have received from Commander B. T. Somerville, R.N., the reprint of a paper by him published in *Spolia Zeylanica*, vol. 5, part 18, in which he deals with the submerged plateau surrounding Ceylon and certain characteristics of its coastline. The author, it will be remembered, commanded the *Sealark* during the recent research expedition in the Indian ocean, and his remarks are in part based on observations during soundings then carried out. The plateau referred to extends to an average distance of 12 miles from the land, when it falls with a well-marked drop to ocean depths. It shoals progressively from south to north, and is also marked by a slight deepening along its central line. As a general result of the ocean circulation in this part of the world, a current circulates round the island in the direction of the hands of a watch during the north-east monsoon, and in the contrary direction during the south-west monsoon, being variable at the change from one to the other. The author suggests that both current and swell are influenced by the existence of the submerged plateau, but does not allude to any influence which currents may have had on the origin of the plateau, though he remarks that the absence of the finer "green mud" from its surface may be due to its removal to greater depths by bottom currents. As regards the present coast-line, he calls attention to the strange absence of coral reefs all round the southern part of the island, and suggests that the outward extension of the coast progresses at such a rate as to prevent the

* On the Society's map of Tibet it is marked hypothetically just west of 86° E.

growth of coral. Another feature is the occurrence of lakes or lagoons all round the island, though their frequency and character vary from east to west and from north to south. They are held to point also to a rapid extension seawards of the lower portion of the island, which would itself seem to be composed of the detritus from the ancient mountainous core, under the action of the violent monsoon rains. The differences in the number and form of the lagoons is attributed to the differences in the character of the two monsoons, to the varying breadth of the lowlands, and to the effect of currents. Commander Somerville's general conclusion is that the low country of Ceylon has been derived from the denudation of the mountain country, and has been laid down on a plateau of which the existing 12-mile fringe is but a remnant. May not the plateau itself, however, be, in part at least, a product of recent denudation, as it would seem to be merely the submarine continuation of the lowlands?

The New Flora of Krakatau.—The great volcano of Krakatau, which by its famous eruption of 1883 destroyed every vestige of plant-life upon it, has afforded an unusually instructive object-lesson on the colonization of new land by vegetation, which can only be studied by actual observation on any large scale in the case of such exceptional occurrences. Visits by Dr. Treub, of the Buitenzorg botanic garden in Java, in 1886 and 1897, permitted the early stages of the re-peopling of the island by plants to be studied, and showed what an unusually important part was being played by the wind, as compared with other agencies, in affecting the transport of seeds, spores, etc., to the unoccupied surface. Thus, while in other cases that have been studied (those of coral and other low-lying islands) it has been the shore vegetation which has been most rapidly developed, in the case of Krakatau the inland species (particularly ferns) made good their footing equally quickly and in even greater numbers. A further study of the process has lately been made by Prof. A. Ernst of Zürich, who, thanks to the help of Dr. Treub, was able, with two companions, to pay a visit to Krakatau and neighbouring parts of the Straits of Sunda in April, 1906. A description of the visit, with a full discussion of the phenomena observed, appears in the *Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich*, Jahrgang 52, Parts 3–4 (Zürich: Füsi u. Beer, 1908). We can here refer only to the observations regarding Krakatau itself, though the flora of other islands in the Straits and of points on the coasts of Java and Sumatra was also examined. The writer and his companions were struck, on approaching the island, with the astonishing progress made by the vegetation, almost the whole south-eastern side, from the shore to the summit, being clothed in green. The present flora embraces all sections of the vegetable kingdom, and the total number of species collected during the three visits of 1886, 1897, and 1906 amounts to 137. An interesting section of the paper discusses the life-conditions afforded by Krakatau since the eruption, showing that the chemical composition of the soil and its physical properties were not so unfavourable as might be supposed. Apart from nitrates and phosphates, all the substances necessary to plant-growth were present in the volcanic deposits, while the missing constituents would be supplied through the agency of the wind, waves, rain, etc. Both algæ and bacteria would play an important part in preparing the soil for plant-life. Prof. Ernst enters fully into the question of the various modes of transport of plants and their seeds to the island (by the wind, currents, birds, etc.). The important part played by the wind may be explained by the comparative nearness of Krakatau to other lands, which permits the transport by wind of the seeds of such orders as *Gramineæ*, *Cyperaceæ*, and *Orchideæ*, as well as the spores of ferns. It is not easy to decide on the proportion of the flora brought by each agency, but Prof. Ernst concludes that from 39 to 72 per cent. have been brought by currents, 10 to 19 per cent. by birds,

and from 16 to 30 per cent. by the wind. Apart from the number of species, it is surprising how far the differentiation into plant-associations has already progressed.

The Bashi or Batanes Islands.—This small group of islands, first described by William Dampier, lies to the north of the Philippine group, of the territory of which it forms the most northern portion. It is officially designated Batanes, though Dampier's name Bashi (Bashee) is still sometimes used. In the *Philippine Journal of Science*, vol. 3, No. 1 (February, 1908), Mr. H. G. Ferguson gives the preliminary results of a three weeks' geological reconnaissance of the group lately carried out by him. According to the structure of the islands, the group may be divided into three sections, viz. (1) The islands consisting mainly of the older rocks, volcanic agglomerate with basic dykes. To this section belong Sabtan and the southern part of Batan, these being the southernmost of the larger islands. (2) The younger volcanic group, consisting of Mount Iraya in Batan, the island of Inem, and the Siayanes, a small group north of Isbayat. (3) The coral limestone group, Desquey, Ibujos, and most probably Isbayat, the largest of the Batanes. Sabtan is traversed diagonally by a belt of rolling upland terminating eastward in an irregular escarpment of agglomerate, and falling seawards on the west in a still higher line of cliffs. The southern portion is extremely rugged. Batan, in its larger, southern part, is traversed by a range of hills and various irregular spurs, while the northern end is dominated by the volcano Iraya, a beautifully symmetrical cone 3800 feet high. Remains of an older and larger cone still surround it. Marine erosion has cut away the lower slopes, leaving cliffs from 50 to 200 feet in height. The Piedmont region is composed of stratified sandstone and conglomerate, poorly consolidated. In this flat region lies Santo Domingo de Basco, the largest town in the islands, possessing the only harbour with a beach unobstructed by coral. Of the other islands, Ibujos consists entirely of coral limestone rising in steep cliffs to a height of 200 feet, while Isbayat is likewise surrounded by cliffs, the only landing being by means of steps cut in the rock or ladders. The natives of Batan and Sabtan were formerly divided into three hostile clans, and their village forts were built on commanding eminences; but in more recent times these have been abandoned, villages being placed either where gaps in the reefs occurred, or in the neighbourhood of arable land. The natives of Isbayat are more completely isolated, and have retained their own language and a peculiar art of basket making. The islands owe their origin to volcanic outbursts, and vulcanism has been a factor in all stages of their history, interfering with the normal geographical cycle. In recent times there has been a lessening of area. The physical features are illustrated by photographs.

AFRICA.

Grass-burning in Tropical Africa.—As is well known, it is a general custom among the natives of the more open parts of tropical Africa to burn down the grass annually, in order, among other objects, that the old and withered grass may be cleared away and give room for the growth of the fresh and tender herbage. The precise effect of this practice on the vegetation generally has not yet been studied so systematically as could be wished, and very divergent views have been expressed by travellers as to the preponderance of benefit or the reverse when a balance is struck. A beginning in the desired direction has lately been made by Dr. Walther Busse, a member of the Imperial Biological Institute for Agriculture and Forestry, who has made a careful study of the subject during his residence in the German African territories, and has likewise collected a considerable body of other observations from the published accounts of travellers. The results are put

forward in a paper printed in the *Mitteilungen aus den Deutschen Schutzgebieten*, 1908, No. 2. Dr. Busse has drawn chiefly, it is true, upon the observations of German travellers, and hardly extends his survey beyond the borders of German African territories, but the extent of country covered by these in various parts of the continent justifies us in regarding them as more or less typical of the whole. As an introduction to the subject, Dr. Busse enters at some length into the mode of origin of the African steppes (under which term he includes all the unforested regions, including those sometimes distinguished as savannahs), and he shows reason for thinking that the greater part of these was once forest-clad, the former forests having been destroyed by human agency. Togo, though naturally a part of the West African forest belt, is now essentially a region of steppes, and this fact is ascribed to the considerable southward movement of peoples of which the region has been the scene. When once the forest has been cleared for purposes of agriculture, it has little chance of establishing itself afresh in its original form, though an intermediate type of bush vegetation often holds the ground for a time before the true grass steppe, characterized above all by species of *Andropogon*, is found. As regards the effect of the annual grass-burnings, this varies immensely in different localities, both according to the height and density of the grass, and to the conditions of moisture in the soil, the greatest damage to trees being of course done where the sub-soil is dry. Again, some trees are far better able than others to adapt themselves to the altered conditions, and these are the species which still hold their own, either singly or as scattered forest, in the midst of the steppe-lands. They are considered by Dr. Busse as representing, in general, the remnants of a former moist forest, not as species which have since established themselves in the steppe-lands. While recognizing to the full the impossibility of re-establishing the old moist forest in the steppes, Dr. Busse insists on the importance of systematic forestry in the African possessions, and shows how much the task is made difficult by the grass-burnings, which therefore need to be placed under restrictions. The fertilizing value of the ash is inconsiderable, except for the grass itself, as it lacks many of the constituents needed by other crops. For pastoral operations, however, the burning is a necessity, as otherwise the new growth has little chance of making headway. It is thus important to pay regard to local circumstances in any discussion of the question.

AUSTRALASIA AND PACIFIC ISLANDS.

Early French Voyages to the Pacific.—Comparatively little has been known, at least by the general reader, respecting the early French commercial ventures in the Pacific, anterior to the voyage of Bougainville. A useful contribution to this subject has been made by Mr. Dahlgren, Director of the Royal Library at Stockholm, who has for some time been known as a student of Pacific voyages.* In vol. 14 of the *Nouvelles Archives des Missions Scientifiques* he has given a concise outline of the history of French enterprise in the Pacific between 1695 and 1749, with a systematic list of all the ships sent out from France during that interval, a summary statement of the course and results of the voyages, and a reference to the authority in each case. The work is to a large extent based on original research in the official French archives and elsewhere. French commercial enterprise in this direction may be said to have dated from the foundation of the "Compagnie de la

* In 1900 he published, as vol. 13 of *Ymer*, an account of various French voyages in the early part of the eighteenth century, though, through being written in Swedish, it has not been widely available.

mer du Sud" in 1698, and the period of greatest activity was from 1705 to 1724, for though on the conclusion of a treaty with Philip V., the French king was complaisant enough to forbid the enterprise of the company, the trade proved so lucrative that it was maintained for a time in contraband form. But the more stringent prohibitions issued by Louis XIV. in 1716, and renewed in 1724, finally put a stop to it, and the French ships employed in the later voyages were mostly freighted by Spanish merchants. Contemporary statements as to the specie brought into France during the early part of the century place the amount at a very high figure, but Mr. Dahlgren thinks that these must be received with caution. The number of ships despatched between 1695 and 1726 works out as 168, of which 117 returned, while the remainder were either sold, lost, or seized by the Spanish authorities.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Mountain Morphology.—In part i. of the ninth volume of Penck's *Geographische Abhandlungen*, Dr. Gustav Götzinger discusses the origin of round-backed ridges in mountain districts. The slopes of two adjacent valleys may meet in a sharp ridge, or a more or less level strip of land may intervene—an "even-topped upland" in Prof. Davis's nomenclature—or, thirdly, a round back, Prof. Davis's "subdued hill," may fall gradually to the valley slopes. The development of the last form from the other two has been studied by the author for four years in various regions, but chiefly in the Wiener Wald during excursions with Prof. Penck. In the Wiener Wald, where the sculpturing of the valleys is almost everywhere complete, the principal agent in the formation of rounded backs is the gradual creeping down of the detritus, which has covered up the inequalities of the slopes, protecting the rocks, whether hard or soft, from erosion, and leaving the ridges or the edges of the flat uplands exposed to atmospheric action. Sharp rocks on the summit are eaten away, and a narrow rounded back is formed which is gradually broadened by the weathering of the top and the creeping down of the waste. The gentler the slope, the slower is the development of broad summits, and vegetation also retards the progress of denudation, though, particularly on gentler slopes, the roots promote the movement of the detritus, and here the formation of loam soaked with water, which runs off less freely, keeps up the creeping motion. Though creeping may be observed in many climates, even in rainless deserts where it is a consequence of extremes of temperature, it may not always be the predominating factor, for in deserts deflation plays an important part. Dr. Götzinger was, therefore, desirous of examining the formation of subdued mountains in another country, and for this purpose made an excursion to Istria, where the rain is torrential and there are long intervals of drought. He was also able to compare the flysch country of Istria with that of the Wiener Wald. In this formation he found that the wind had a certain effect, though the larger forms were here also due to creeping, but in the limestone region there are no rounded crests, for the *débris* is insufficiently protected by the scanty vegetation, and is washed away by the heavy rains. Lastly, Dr. Götzinger inquires whether there are traces in the flysch of the Wiener Wald of different climates in earlier ages with other forms of denudation. His answer is that the older forms of the rounded backs are entirely obliterated, and that even those of the Ice Age cannot be determined with certainty. These general results are based on a long series of observations, which are illustrated by sketches and photographs.

GENERAL.

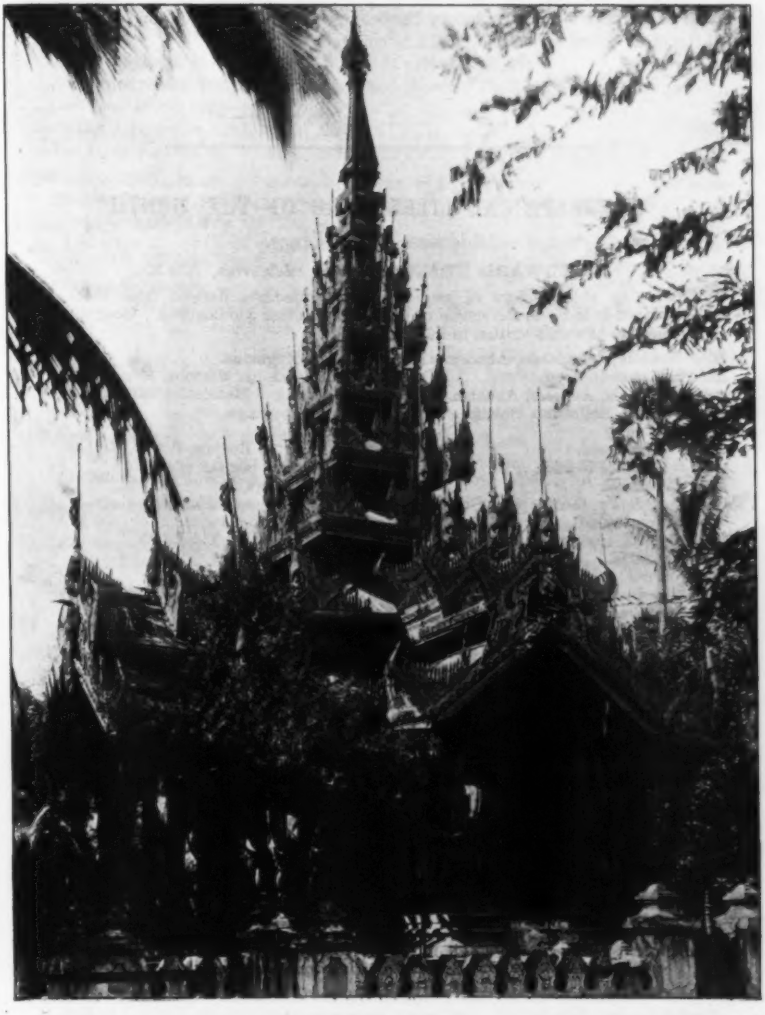
A Geographer's Life-work.—On September 7 last, Mr. and Mrs. E. G. Ravenstein celebrated the fiftieth anniversary of their wedding, and in connection with this auspicious event Mr. Ravenstein has printed for private circulation a list of the most important maps, books, and papers drawn, compiled, or written by him from 1853 to the present time. Although not by any means exhaustive, the list forms a brochure of forty-seven pages, and bears witness to the untiring industry and close application exhibited by the veteran geographer during his long and busy career. The headings under which the publications are grouped show also the many-sided character of his geographical labours, which, apart from his valuable contributions to cartographical progress, have embraced such subjects as climatology, political geography and statistics, and varied studies in the history of geography and exploration. It is worth calling special attention to his work in connection with a British Association Committee for the consideration of methods of map-making as applied to the physical map of the British islands. Specimen maps prepared by him were tinted in nine different ways, in one of which the colours of the prism were employed with success in regular succession. It is not perhaps widely known that a subject in which he at one time took a keen interest was that of physical education, with especial reference to the adoption of a national system in elementary schools. An essay on this subject was awarded the first prize by the National Olympic Association, founded at Liverpool in 1865. He also prepared a 'Handbook of Gymnastics and Athletics,' which saw the light in 1867. We wish him health to enjoy a well-earned rest from his more arduous labours, while trusting that geography may still continue to reap the fruit of his wide knowledge and experience.

Geographical Course at the London School of Economics.—An instructive series of lectures and classes is, as usual, arranged at this school for the academic year now opening, and although primarily intended for those who approach the subject from the economic side, the study is throughout based on physical geography, and the course will therefore supply a good general insight into geographical methods and applications. In the Michaelmas Term an introductory course by Mr. Mackinder will deal with such methods as illustrated by a study of two special regions, and in connection with it a class will be held by Mr. Sargent, on the use of maps in Economic Geography and the general relations of geographical facts to industry and commerce. In the Lent and summer terms Mr. Mackinder will deliver a course on Regional Geography, the great divisions of the world being considered in order. In the same terms Mr. Sargent will deal with Economic Geography, applying in detail to special regions the general principles studied in the previous course. Other items in the programme are a course by Mr. Mackinder on "The Map of Europe studied Historically" (in which preference will be given to teachers, should it be necessary to limit the class), and one by Mr. Sargent in which Modern Historical Geography will be illustrated by a study of the geographical factor in the political and economic development of North America. Several of the courses will be repeated at 7 p.m. for the special benefit of evening students.

CORRESPONDENCE.

Burma.

WITH the assistance of Mr. J. C. Clancey and Mr. Taw Sein Ko, the Burma Government archæologist, I have now been able to identify the "Snake Kyaung" in



TILIN-DAIK-THEIN

Mandalay, referred to in my review of Sir George Scott's book on Burma, published in the Society's *Journal* (vol. **30**, pp. 431 *et seq.*) as the Tilin-daik-Thein. It appears that the *thein*, or "ordination hall," has been renovated by plain multiple roofing to replace the original carved roof, which was in a tottering condition when I last saw it in 1904. Of course, the character of the original structure has considerably altered in appearance, much to its detriment, but the present roofing, being of a more durable nature than a wooden one, will serve at any rate to preserve the carved supports and pillars, which, after all, are the most fascinating parts of the building. Mr. Clancey has been good enough to send me a photograph of the *thein* before renovation, which is now reproduced.

J. R. H.

August 8, 1908.

GEOGRAPHICAL LITERATURE OF THE MONTH

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Central Europe—Meteorology. *Petermanns M.* **54** (1908): 57–60. **Knörzer.**
Temperaturanomalien in Mitteleuropa, hervorgerufen durch südöstliche und südwestliche Maxima. Eine klimatologische Studie von A. Knörzer. *Maps.*

Europe—Ethnography. **Deniker.**
Association Française pour l'Avancement des Sciences: Congrès de Lyon, 35e Session, 1906. Les races de l'Europe. II. La taille en Europe. Par J. Deniker. Paris, 1908. Size 10 × 6½, pp. 144. *Map.*

France—Hérault. *B.S. Languedoc. G.* **31** (1908): 86–118. **Gennevaux and Mauche.**
Recherches spéléologiques dans la région du Pic Saint-Loup. Par Maurice Gennevaux et Albert Mauche. *Map, Sections, and Illustrations.*

France—Morbihan. *B.I. Océanogr. Monaco*, No. 116 (1908): pp. 30. **Joubin.**
Études sur les gisements de mollusques comestibles des côtes de France: le Morbihan oriental. Par L. Joubin. *Maps.*

France—Relief. *Ann. G.* **17** (1908): 205–223. **Briquet.**
La pénéplaine du nord de la France. Par A. Briquet. *Maps and Sections.*

Germany—Baden. *G.M. Hessen* **4** (1908): 67–116. **Riedel.**
Die Einteilung des Odenwalds in orographische Gruppen. Ein Beispiel für die Ergebnisse orometrischer Untersuchungen zur Einteilung von Gebirgen. Von Wilhelm Riedel. *Map and Sections.*

Germany—Cartography. *Globus* **94** (1908): 1–6. **Wolkenhauer.**
Seb. Munsters verschollene Karte von Deutschland von 1525. Von Dr. August Wolkenhauer. *Facsimile-map.*
Two copies of this map have lately been brought to light (*ante*, p. 424).

Germany—Danube. *Deutsche G. Blätter* **31** (1908): 109–116. **Verbeek.**
Die Donauversickerung bei Immendingen. Von Dr. Paul Verbeek.
See note in vol. **31**, p. 440.

Germany—Hessen. *G.M. Hessen* **4** (1908): 1–66. **Loos.**
Zur Hydrographie des Westerwaldes. Von Fritz Loos. *Map and Sections.*

Germany—Rhine Basin. *Petermanns M.* **54** (1908): 73–78. **Oestreich.**
Studien über die Oberflächengestalt des Rheinischen Schiefergebirges. Von Dr. Karl Oestreich. *Map.*
Discusses the physical geography of the middle Rhine valley and neighbouring highlands in Pliocene times.

Holland—Rotterdam. **Lintum.**
Ts. K. Nederland. Aardr. Genoots. **25** (1908): 197–252, 443–469.
De oorzaken van Rotterdam's opkomst en ontwikkeling. Door Dr. C. te Lintum.

Iceland. *Globus* **93** (1908): 181–185. **Spethmann.**
Dr. v. Knebels Islandexpedition im Sommer 1907. Vorläufiger Reisebericht von Hans Spethmann. *Sketch-map and Illustrations.*
See note in the June number, p. 672.

Italy—Apennines. *Riv. G. Italiana* **15** (1908): 193–207. **Martelli.**
Di alcune recenti idee sulla struttura dell' Appennino, e specialmente di un preteso carreggiamento Dalmato-Garganico. Del dott. Alessandro Martelli.

Italy—Geographical Terms. **Lorenzi.**
Riv. G. Italiana **15** (1908): 28–43, 78–90, 149–169.
Geonomastica Polésana. Termini geografici dialettali raccolti nel Polesine da Arrigo Lorenzi.

Italy—Piedmont. *Riv. G. Italiana* **15** (1908): 208–225. **Revelli.**
Il Lago di Co' di Lago (Devero; Ossola). Ricerche del prof. Paolo Revelli. *Sketch-map and Illustration.*

Italy—Sicily—Etna. *C.R.A. Sc. Paris* **146** (1908): 1071–1076. **Lacroix.**
Sur la récente éruption de l'Etna. (Taormina, 15 mai 1908.) Note de M. A. Lacroix.
Although considerably more than the average interval had elapsed since the last previous eruption (1892), that of May 15 last was but of slight importance.

Spain—Sierra Nevada. *Z. Ges. E. Berlin* (1908): 294–316, 407–426. **Quelle.**
Beiträge zur Kenntnis der spanischen Sierra Nevada. Von Dr. Otto Quelle. *Illustrations.*

ASIA.

Asia—Historical. **Sumpa Khan-po.**
Pag Sam Jon Zang. Part I. History of the rise, progress, and downfall of Buddhism in India (pp. viii., iv., 146, and cxlviii.). Part II. History of Tibet from early times to 1745 A.D. (pp. x., xxvi., and 147–430). By Sumpa Khan-po Yeçe Pal Jor . . . edited by Sarat Chandra Das. Calcutta, 1908. Size 9½ × 6. [In Tibetan. Introductions, contents, and analytical index to Part I. (pp. i.–cxlviii.) in English.]

Ceylon—Historical. *J. Ceylon Branch R. Asiatic S.* **19** (1908): 284–400. **Ferguson.**
Discovery of Ceylon by the Portuguese in 1506. By Donald Ferguson. *Portraits and Illustration.*

Ceylon—Morphology. **Somerville.**

The submerged plateau surrounding Ceylon: some considerations regarding the formation of the coast-line. By B. T. Somerville. (Reprinted from 'Spolia Zeylanica,' vol. 5, part xviii., April, 1908.) Size 9½ × 6, pp. 69–78. *Maps and Sections.*

See note, *ante*, p. 427.

China—Hong Kong.

List of villages in New Kawloon in the Southern District [of the new territory of Hong Kong] (pp. 3). List of villages in the Northern District of the New Territory (pp. 10). Chinese names of islands, bays, hills, and passes in the War Office map of Hong Kong and the Leased Territory (pp. 5). [Hong Kong, 1907.] Size 13 × 8½.

China—Sechuan. *Ts. K. Nederland. Aardr. Genoots.* **25** (1908): 470–512. **Abendanon.**

Overzicht der geographie en geologie van het "Roode Bekken," in de provincie Se-tsjoean (Midden-China). Door E. C. Abendanon. *Maps and Illustrations.*

China—Sechuan. **Guébriant.**

Missions Catholiques **40** (1908): 164–166, 172–173, 199–203, 207–209, 221–224.

Chez les Lolos. Par le R. P. de Guébriant. *Illustrations.*

Father Guébriant has been known for some time as one of the most active of the French missionaries in Western China.

China—Yunnan. *La G., B.S.G.* **17** (1908): 247–252. **D'Ollone.**

La Mission d'Ollone. *Map.*

See note in the August number, p. 183.

Chinese Empire. *Z. Ges. E. Berlin* 1908: 377–395. **Tafel.**

Vorläufiger Bericht über seine Studienreise in Nord-West China und Ost-Tibet. Von Dr. Albert Tafel. *Illustrations.*

Dr. Tafel's journey has been frequently referred to in the *Journal.*

India—Himalaya. *Alpine J.* **24** (1908): 107–133. **Longstaff.**

Mountaineering in Garhwal. By T. G. Longstaff. *Map and Illustrations.*

India—Himalaya. *Alpine J.* **24** (1908): 139–148. **Workman.**

Nieves Penitentes in Himalaya. By William Hunter Workman. *Illustrations.*

AFRICA.

Abyssinia—Historical. **Beccari.**

Rerum Æthiopicarum Scriptores Occidentales inediti a Sæculo XVI. ad XIX., curante C. Beccari. Vol. 6. P. Emmanuelis d'Almeida, S.J., Historia Æthiopiæ; Liber v.–viii. Rome: C. de Luigi, 1907. Size 10½ × 7½, pp. xii. and 534. *Price* 20*s.* 8*d.*

Abyssinia—Kaffa. *Globus* **93** (1907): 165–169, 186–189. **Bieber.**

Das staatliche Leben des Kaffitscho. Von Friedrich J. Bieber. *Illustrations.*

Africa—Phytogeography. *M. deuts. Schutzgebieten* **21** (1908): 113–139. **Busse.**

Die periodischen Grasbrände im tropischen Afrika, ihr Einfluss auf die Vegetation und ihre Bedeutung für die Landeskultur. Von Dr. Walter Busse. *Illustrations.*

See note, *ante*, p. 429.

Cape Colony. **Manning.**

Trout-fishing in the Cape Colony. By Dumaresq W. Manning. Cape Town: Argus Publishing Co., 1908. Size 9½ × 6, pp. 98 and xxxiv. *Map and Illustrations. Presented by the Publishers.*

Central Africa. *Deutsches Kolonialblatt* **19** (1908): 671–677. **Mecklenburg.**

Die zentralafrikanische Expedition S.H. des Herzogs Adolf Friedrich zu Mecklenburg-Schwerin.

Central Africa—Communications. *Mouvement G.* **25** (1908): 301–306. **Wauters.**

Les voies d'accès au Katanga. Par A. J. Wauters. *Maps.*

Dahome. **Hubert.**

Henry Hubert. Mission scientifique au Dahomey. Paris: E. Larose, 1908. Size 10 × 6½, pp. 568. *Maps and Illustrations. Price* 15 *fr. Presented by the Author.*

An expert description of the physical conditions of the country.

Egypt—Nile. *P.S. Biblical Archæology* **30** (1908): 206–207. **Platt.**
The origin of the name of the island of Elephantine. By A. F. R. Platt. *Illustration.*

Suggests that the name originated in the shape of some of the rocks.

Egypt—Nubia. *Cairo Sc. J.* **2** (1908): 185–190. **Scott.**
Note on the present Nubian survey. By T. D. Scott.

Egypt and Sudan.
Egypt No. 1 (1908): Reports by His Majesty's Agent and Consul-General on the finances, administration, and condition of Egypt and the Sudan in 1907. London: Wyman & Sons, 1908. Size 13 × 8½, pp. 68. *Price* 7½*d.*

French Congo. *La G., B.S.G.* **17** (1908): 256–261. **Bel.**
Étude géologique et minière du bassin du Niari. Par J.-M. Bel. *Sketch-map.*

French Congo—Railway. *La G., B.S.G. Paris* **17** (1908): 261–264. **Mornet.**
Reconnaissance d'un tracé de voie ferrée de Brazzaville à l'Océan. Par le Capitaine Mornet. *Sketch-map.*

NORTH AMERICA.

Alaska. *Smithsonian Misc. Coll.* **51** (1908), No. 1807: pp. 38. **Gilmore.**
Smithsonian exploration in Alaska in 1907 in search of Pleistocene fossil vertebrates. By Charles W. Gilmore. *Maps.*

Alaska. *U.S. Geol. Surv. Water-supply Paper* **218** (1908): pp. 156. **Henshaw and Covert.**
Water-supply investigations in Alaska. 1906–1907. By Fred. F. Henshaw and C. C. Covert. *Maps and Illustrations.*

America—Fauna. **Lobley.**
The American Fauna and its origin. By Prof. J. Lobley. (From the *Transactions of the Victoria Institute*, April 6th, 1908.) Size 8½ × 5½, pp. 32. *Presented by the Author.*

Canada—British Columbia. **Ells.**
Annual Rep. Geol. Surv. Canada **16** (1904), *Rep. B.*: pp. 46.
Report on Graham Island, B.C. By R. W. Ells. *Maps.*

Canada—British Columbia. **Leach.**
The Telkwa river and vicinity, B.C. By W. W. Leach. Ottawa, 1907. Size 9½ × 6, pp. 24. *Map.*

Canada—North-West. *J.R. Statistical S.* **71** (1908): 397–404. **Godfrey.**
Settlement and agriculture development of the North-West Provinces of Canada. By Ernest H. Godfrey.

Canada—Ontario. **Collins.**
Department of Mines. Report on a portion of North-Western Ontario traversed by the National Transcontinental Railway between Lake Nipigon and Sturgeon Lake. By W. H. Collins. Ottawa: S. E. Dawson, 1908. Size 10 × 6½, pp. 24. *Map and Illustrations.*

The map embodies all the geological data available.

Canada—Yukon. **Camsell.**
Annual Rep. Geol. Surv. Canada **16** (1904): *Rep. CC.*: pp. 50.
Report on the Peel river and tributaries, Yukon and Mackenzie. By C. Camsell. *Map and Illustrations.*

Describes explorations carried out in 1905, and already referred to in the 'Summary Report' for that year (*Journal*, vol. 29, p. 348).

Canada—Yukon. *Annual Rep. Geol. Surv. Canada* **16** (1906), *Rep. C.*: pp. 24. **Keele.**
Report on the upper Stewart river region, Yukon. By J. Keele. *Map and Illustrations.*

North America—Zoology. *National G. Mag.* **19** (1908): 387–446. **Shiras.**
One season's game-bag with the camera. By George Shiras. *Illustrations.*

Describes photographic trips in the West Indies, Florida, New Brunswick, Newfoundland, etc.

United States—Anthropogeography. *J.G.* **6** (1908): 209–214. **Libby.**
Physiography as a factor in community life. By Prof. O. G. Libby.

Illustrates the influence of geography on history by the fortunes of various states of the Union.

CENTRAL AND SOUTH AMERICA.

Argentine—Ethnology. **Ambrosetti.**

Exploraciones arqueólogicas en la ciudad prehistórica de "La Paya" (Valle Calchaqui—Provincia de Salta). Campañas de 1906 y 1907. Par Juan B. Ambrosetti. (Facultad de Filosophia y Lettras: Publ. de la Seccion Antropológica, No. 3 (1ª parte).) Buenos Ayres, 1907 Size 11 × 7½, pp. 278. *Maps, Plans, and Illustrations.*

Bolivia. **Wright.**

Bolivia: the central highway of South America—a land of rich resources and varied interest. By Marie Robinson Wright. Philadelphia and London, [1907]. Size 12½ × 10, pp. 450. *Map and Illustrations. Presented by Colonel Pedro Suarez.*

A profusely illustrated general account of the country, laying stress on its economic advantages and prospects.

Brazil. **Wettstein.**

Brasilien und die deutsch-brasilianische Kolonie Blumenau. Von D. Wettstein. Leipzig: F. Engelmann, 1907. Size 10 × 7½, pp. xiv. and 346. *Maps and Illustrations. Price* 13m. 50.

A general description of the geographical and historical relations of Brazil as a whole serves as an introduction to a particular account of the Blumenau colony in the state of Santa Catharina, primarily from an economic point of view.

Brazil—Phytogeography. **Ule.**

Vegetationsbilder (Karsten and Schenck) **7** (1908): Pls. 13–18.

Das Innere von Nordost-Brasilien. Von Ernst Ule. *Plates.*

Central and South America. **Ronca.**

B.S.G. Italiana **8** (1907): 405–430, 514–542, 679–694, 763–784, 879–902, 1006-1022, 1122–1147, 1238–1258; **9** (1908): 49–66, 157–167, 263-271.

Dalle Antille alle Guiane e all' Amazzonia. Note intorno al viaggio della R. Nave "Dogali" dal febbraio 1904 at luglio 1905, del cap. Gregorio Ronca. *Maps.*

Columbia. *Globus* **93** (1908): 302–305. **Koch-Grünberg.**

Einige Bemerkungen zu der Forschungsreise des Dr. H. Rice in den Gebieten zwischen Guaviare und Caquetá-Yapurá. Von D. Theodor Koch-Grünberg. *Maps.*

Discusses the information contained in Dr. Rice's letter (*Journal*, vol. **31**, p. 308), showing that some of the streams crossed must be the headwaters of the Isanna. The tribe mentioned by Dr. Rice seems to be that of the Enaguas, who have nothing to do with the Omaguas.

Peru. **Enock.**

Peru: its former and present civilisation, history, and existing conditions, topography and natural resources, commerce, and general development. By C. Reginald Enock. London: T. Fisher Unwin, 1908. Size 9 × 6, pp. xxxii. and 320. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Author.*

Venezuela. *Petermanns M.* **54** (1908): 69–70. **Sievers.**

Eine neue Karte von Venezuela. Von W. Sievers. *Map.*

The map presents the results of the new official survey.

Venezuela—Phytogeography. **Jahn.**

Las palmas de la flora venezolana. Monografia botanica, por Alfredo Jahn. Caracas, 1908. Size 9 × 6, pp. 126. *Presented by the Author.*

West Indies—Martinique. **Heilprin.**

The eruption of Pelée: a summary and discussion of the phenomena and their sequels. By Angelo Heilprin. Philadelphia: J. B. Lippincott Co., for the Geographical Society, 1908. Size 14 × 11, pp. viii. and 72. *Portrait and Illustrations. Presented by the Publishers.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Hydrology. **Pittman.**

Geological Survey of New South Wales. Problems of the artesian water-supply of Australia, with special reference to Prof. Gregory's theory. By E. F. Pittman. Sydney, 1908. Size 9½ × 6, pp. 30. *Map, Illustration, and Sections.*

Contests the correctness of Prof. Gregory's views.

Australia—Irrigation. *J.R. Colonial I.* **39** (1908): 421–450. **Coghlan.**

The possibilities and prospects of irrigation in Australia. By T. A. Coghlan.

New Guinea—Dutch. **Hellwig.**

Ts. K. Nederland. Aardr. Genoots. **25** (1908): 584–619.

De Arbeid van het exploratie-detachement in Zuid-Nieuw-Guinea. Naar "Pioneer" en R. L. A. Hellwig. *Map.*

New Guinea—Dutch. **Wichmann.**

Ts. K. Nederland. Aardr. Genoots. **25** (1908): 571–580.

De "Moordenaars-rivier" en de "Doodslagers-rivier" op Nieuw-Guinea. Door A. Wichmann. *Map.*

New Zealand—Southern Islands. *Kew B.* (1908): 237–249. **Cockayne and Smith.**

The Southern Islands expedition. [Extracts from accounts by Dr. L. Cockayne and Captain Dorrien Smith.] *Illustrations.*

Noticed in the September number, p. 310.

Pacific Islands and Malaysia. **Guillemard and Keane.**

Stanford's Compendium of Geography and Travel (New Issue). Australasia. Vol. 2, Malaysia and the Pacific Archipelagoes. By F. H. H. Guillemard. Second edition, revised by Dr. A. H. Keane. London: E. Stanford, 1908. Size 8 × 5, pp. xvi. and 574. *Maps and Illustrations. Price* 15*s. Presented by the Publisher.*

Torres Straits—Ethnology.

Reports of the Cambridge Anthropological Expedition to Torres Straits. Vol. 6. Sociology, magic, and religion of the Eastern Islanders. Cambridge: University Press, 1908. Size 11½ × 8½, pp. xx. and 316. *Maps and Illustrations. Price* 21*s. net. Presented by the Publishers.*

POLAR REGIONS.

Antarctic—Belgian Expedition.

Expédition Antarctique Belge. Résultats du voyage du S.Y. *Belgica* en 1897–1898–1899; sous le commandement de A. de Gerlache de Gomery. Rapports scientifiques. Zoologie: Ostracoden, von G. W. Müller (pp. 8); Holothuries, par E. Hérouard (pp. 16); Insectes (pp. 92); Medusen, von Otto Maas (pp. 32); Cirripedia, by P. P. C. Hoek (pp. 10); Pennatuliden, von Hector F. E. Jungersen (pp. 12); Scaphopoden, von L. Plate (pp. 4); Turbellarien, von Ludwig Böhmig (pp. 32). Océanographie: Relations thermiques; rapport sur les observations thermométriques faites aux stations de sondages, par Henryk Arctowski et Hugh Robert Mill (pp. 36). Géologie: Les glaciers; glaciers actuels et vestiges de leur ancienne extension. Par Henryk Arctowski (pp. 74). Physique du Globe: Mesures Pendulaires, par G. Lecointe (p. 40). Antwerp, 1906–1908. Size 13½ × 11. *Maps, Diagrams, and Illustrations. Presented by the Commission de la Belgica.*

Antarctic—British Expedition. **Mulock.**

National Antarctic Expedition, 1901–1904. Charts. By Lieut. G. F. A. Mulock. London: R.G.S., 1908. Size 10 × 6½, (*Charts*) 6 sheets; (*Text*) 8 pp. *Price* (*to Fellows*) 9*s. net*; (*to non-Fellows*) 12*s.* 6*d. net.*

Antarctic—German Expedition. **Drygalski.**

Deutsche Südpolar-Expedition, 1901–1903. Im Auftrage des Reichsamtes des Innern herausgegeben von Erich von Drygalski. II. Band. Kartographie, Geologie, Heft 2, VI. Band. Erdmagnetismus, Heft 2. Berlin: G. Reimer, 1908. Size 14 × 10½. *Maps, Illustrations, and Diagrams. Presented by the Imperial Foreign Office, Berlin.*

Antarctic—Palæobotany. *Globus* **93** (1908): 366–368. **Neger.**

Die untergegangene Pflanzenwelt der Antarktis. Von F. W. Neger.

Arctic—North-West Passage. **Amundsen.**

Roald Amundsen's 'The North-West Passage;' being the record of a voyage of exploration of the ship *Gjöa*, 1903–1907, by Roald Amundsen; with a supplement by First Lieutenant Hansen. 2 vols. London: A. Constable & Co., 1908. Size

9½ × 6½, pp. (vol. 1) xiv. and 336; (vol. 2) x. and 398. *Maps and Illustrations. Price* 31*s.* 6*d. net. Presented by the Publishers.*

See review in the August number, p. 171.

Arctic—Travel. *B. American G.S.* **40** (1908): 210–213. **Stefansson.**

Suitability of Eskimo methods of winter travelling in scientific exploration. By V. Stefansson.

Arctic Ocean. **Denucé.**

La séconde Expédition Polaire Allemande, 1869–1870. Une liste inédite de sondages d'eau de mer profonde du Capitaine Hegemann. Par J. Denucé. Brussels, 1907. Size 9 × 6, pp. 10.

The list has been supplied by Captain Hegemann, who commanded the *Hansa* in 1869.

MATHEMATICAL GEOGRAPHY.

Cartography—Terminology. **Pollacchi.**

Lecture des cartes anglaises et des États-Unis. Indications linguisques, géographiques et topographiques. Par Captain P. Pollacchi. Paris: R. Chapelot et Cie., 1908. Size 10 × 8, pp. 158. *Diagrams. Presented by the Author.*

Mr. Knox's 'Glossary of Topographical Terms,' issued as a volume of 'Stanford's Compendium,' seems to have been largely drawn upon in the compilation of this work.

Geodesy. **Krüger.**

Veröffentlichung des Königl. Preussischen Geodätischen Institutes, Neue Folge, No. 34. Bedingungsgleichungen für Liniennetze und für Rückwärtseinschnitte. Von L. Krüger. Potsdam, 1908. Size 11 × 9, pp. 50. *Diagrams.*

Height-determination. *Met. Z.* **25** (1908): 193–200. **Mohn.**

Neue Studien über das Hypsometer. Von H. Mohn.

Position determination. **Rambaldo.**

Astronomische Ortsbestimmung im Ballon. Von Oberleutnant A. E. Rambaldo. (Sonderabdruck aus 'Illustrierte aeronautische Mitteilungen,' Heft **10**, 1908.) Berlin, 1908. Size 10 × 6½, pp. [8].

Surveying. **Clancey.**

Aid to land-surveying, embracing chain, compass, plane-table, and theodolite surveying, levelling, practical astronomy, etc. 3rd (Large) edit. (pp. xvi., 274, and xvi.). Calculating tables, embracing Survey Section (part i.). 5th edit. (pp. lxxviii. and 172). By J. C. Clancey. Rangoon, 1906. Size 13¼ × 8¼. *Maps, Diagrams, and Illustrations. Presented by the Author.*

A well-known work, much used in British India.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Aeolian Deposits. **Ivchenko.**

La stratification dans les dépôts éoliens. Par Alexandre Iwtschenko. (Extrait de *l'Annuaire géologique de la Russie*, tome 10, livr. 1–2.) [Novo Alexandria, 1908.] Size 11 × 9½, pp. 18–29. [In Russian; French *résumé*.]

Climate and Man. **Ward.**

Climate, considered especially in relation to man. By Robert de Courcy Ward. London: J. Murray, 1908. Size 8½ × 5½, pp. xvi. and 372. *Maps and Diagrams. Price* 6*s. net. Presented by the Publisher.*

Geological History. **Köhler.**

Die Entstehung der Kontinente, der Vulkane und Gebirge. Von P. Osw. Köhler. Leipzig: W. Engelmann, 1908. Size 9 × 6, pp. 58. *Price* 1*s.* 9*d.*

Geomorphology—Mountains. **Sölch.**

Forschungen deuts. Landes- u. Volkskunde **17** (1908): 118–274.

Studien über Gebirgspässe, mit besonderer Berücksichtigung der Ostalpen. Versuch einer Klassifikation. Von Dr. Johann Sölch. *Illustrations.*

Geomorphology—River-banks. *Ann. G.* **17** (1908): 193–196. **Girardin.**

Sur l'allure rectiligne des rives dans les cours d'eau à méandres encaissés, les torrents glaciaires et les lacs de montagne. Par Paul Girardin.

Geophysics. *Popular Sc. Monthly* **72** (1908): 492–502. **Huntington.**

Coincident activities of the Earth and the Sun. By Dr. Ellsworth Huntington. *Diagrams.*

Discusses the connection between solar activity and terrestrial phenomena, especially seismic and volcanic.

Geophysics. *C.R.A. Sc. Paris* **146** (1908): 1065–1067. **Berget.**

Utilisation des failles pour la détermination de la densité moyenne de la terre. Par A. Berget. *Diagram.*

The writer suggests that observations of the deflection of the plumb-line in the neighbourhood of vertical fault-scarps might simplify the determination of the mean density of the Earth, but it seems doubtful whether his method is justified.

Geophysics and Biogeography. *G.Z.* **14** (1908): 268–274. **Maas.**

Bemerkungen zu Simroths Pendulationstheorie. Von O. Maas.

The theory was developed last year by H. Simroth in a work of over 500 pages. It supposes a secular swinging of the Earth about an axis passing through Ecuador and Sumatra.

Hydrology. *U.S. Geol. Surv., B.* No. 319 (1908): pp. 44. **Fuller.**

Summary of the controlling factors of artesian flows. By Myron L. Fuller. *Sections and Illustrations.*

Hydrology. *Sc. P.R. Dublin S.* **11** (1908): 295–316. **Richardson.**

The lines of flow of water in saturated soils. By Lewis F. Richardson. *Diagrams.*

Hydrology. *B.S.G. Lyon* **1** (1908): 12–29. **Tessier.**

Le déboisement et les inondations. Par L. F. Tessier.

Ice. *Nature* **78** (1908): 102–104. **Barnes.**

Formation of ground or anchor ice, and other natural ice. By H. T. Barnes. *Illustrations.*

Ice. **Drygalski.**

Beobachtungen an Gletschern und Inlandeis. Von Prof. Dr. Erich von Drygalski. (Sonderabdruck aus Lehrbuch der praktischen Geologie, von Prof. Dr. Konrad Keilhack, Zweite Auflage.) Stuttgart, 1908. Size 9½ × 6¼, pp. 268–285.

Intended as a guide to observers.

Limnology—Seiches. *Petermanns M.* **54** (1908): 39–47, 60–68, 86–88. **Endrös.**

Vergleichende Zusammenstellung der Hauptseichesperioden der bis jetzt untersuchten Seen mit Anwendung auf verwandte Probleme. Von Dr. Anton Endrös. *Diagrams.*

Meteorology. **Scott.**

Meteorological Office. The Observer's Handbook. A new and revised edition of Dr. R. H. Scott's instructions in the use of meteorological instruments. London, 1908. Size 9¼ × 6, pp. 134. *Map, Illustrations, and Diagrams.*

Meteorology—Humidity. *Met. Z.* **25** (1908): 206–215. **Kremser.**

Der Einfluss der Grossstädte auf die Luftfeuchtigkeit. Von V. Kremser.

Meteorology—Instruments. *Quarterly J.R. Meteorol. S.* **34** (1908): 97–111. **Gold.**

Comparison of ships' barometer readings with those deduced from land observations. With notes on the effect of oscillatory motion on barometer readings. By Ernest Gold. *Diagrams.*

Meteorology—Solar Radiation. ———

Annals of the Astrophysical Observatory of the Smithsonian Institution. Vol. 2. By C. G. Abbot and F. E. Fowle. Washington, 1908. Size 13 × 9½, pp. xii. and 246. *Diagrams and Illustrations.*

Part ii. (pp. 125–201) deals with solar radiation and terrestrial temperature.

Meteorology—Temperature. *Met. Z.* **25** (1908): 241–246. **Maurer.**

Die Wärmeabnahme mit der Höhe in den Schweizer Alpen. Von J. Maurer.

See note, *ante*, p. 423.

Meteorology—Upper Air. *P.R.S.*, Ser. A. **80** (1908): 530–534. **Mallock.**

Note on the ascent of meteorological balloons and the temperature of the upper air. By A. Mallock. *Diagrams.*

Meteorology—Winds. **Platania.**

Giovanni Platania. Le osservazioni del vento in mare e la scala di Beaufort. (Estratto dall' Annuario del R. Ist. Nautico "Duca degli Abruzzi" di Catania, vol. 2, Anno 1908.) Catania, 1908. Size 9 × 6, pp. 25–42. *Illustrations and Diagrams.*

Morphology—Earth and Mars. **Merian.**

Mars und Erde: eine vergleichend planetographische Studie. Von E. P. Merian. Basle: F. Reinhardt, 1908. Size 9 × 6, pp. 42. *Maps.* *Price* 1m. 60. *Presented by the Publisher.*

The author sees striking resemblances between the major surface features of the Earth and those of Mars.

Oceanography—Baltic. **Witting.**

Finnländische hydrographisch-biologische Untersuchungen, No. 2. Untersuchungen zur Kenntnis der Wasserbewegungen und der Wasserumsetzung in den Finland umgebenden Meeren. I. Von Rolf Witting. Der Bottnische Meerbusen in den Jahren 1904 und 1905. Erster Teil. Helsingfors, 1908. Size 12½ × 9½, pp. x. and 246. *Maps, Sections, and Diagrams. Presented by the Author.*

Oceanography—Pacific. *G.Z.* **14** (1908): 241–250. **Perlewitz.**

Die Gräben im stillen Ozean. Von Paul Perlewitz. *Map and Sections.*

Discusses the features brought to light by the soundings of the *Edi* and *Stephan* (*Journal*, vol. **29**, p. 679).

Oceanography—Relief. *B.S.G. Italiana* **9** (1908): 249–257. **Ricchieri.**

Per la terminologia dei fondi oceanici. Relazione del Prof. G. Ricchieri.

Physical Geography. *B.S.G. Italiana* **9** (1908): 226–248. **Marinelli.**

Del moderno sviluppo della geografia fisica e della morfologia terrestre. Dal Prof. Olinto Marinelli.

Rivers and Rainfall. **Oppokoff.**

Variations périodiques de longue durée du débit et des depôts atmosphériques dans les bassins fluviaux. Par E. Oppokov. St. Petersburg, 1908. Size 8 × 5½, pp. 40. *Diagrams.* [In Russian; French *résumé.*]

Seismology. *Beiträge Geophysik* **9** (1908): 201–236. **Davison.**

The investigation of earthquakes. By Charles Davison. *Diagrams.*

Tides. *J. Coll. Sc. Tōkyō* **24** (1908): pp. viii. and 114. ———

An investigation of the secondary undulations of oceanic tides, carried out by the order of the Earthquake Investigation Committee during 1903–1906. *Maps, Illustrations, and Diagrams.*

Volcanoes—Nomenclature. *Z. Ges. E. Berlin* (1908): 336–339. **Jaeger.**

Krater, Caldera, and Baranco. Eine Bemerkung zur morphologischen und vulkanologischen Nomenklatur. Von Dr. Fritz Jaeger.

A proposal to apply precise and distinct meanings to the three terms.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *Popular Sc. Monthly* **72** (1908): 503–511. **Carney.**

Springs as a geographic influence in humid climates. By Prof. Frank Carney. *Map and Illustrations.*

On the influence of springs on the location of settlements.

Anthropogeography. *B. American G.S.* **40** (1908): 193–209. **Semple.**

Oceans and enclosed seas: a study in anthropogeography. By Ellen Churchill Semple.

Commercial. **Gannett and others.**

Commercial geography. By Henry Gannett, Carl L. Garrison, and Edwin J. Houston. New York (London: G. Philip & Son), [1908]. Size 8½ × 5½, pp. vi., 416, and 30. *Maps and Illustrations. Price* 6*s. net. Presented by the Publishers.*

Historical—Age of Discovery. **Grauert and Hartig.**

Die Entdeckung eines Verstorbenen zur Geschichte der grossen Länderentdeckungen. Ein Nachtrag zu Dr. Richard Staubers Monographie über die Schedelsche Bibliothek. Von Dr. Hermann Grauert. Der Brief des Dr. Hieronymus Münzer von 14 Juli 1493 über die Westfahrt nach Kathay in portugiesischen Druckausgaben. Von Dr. Otto Hartig. (Aus dem Historisches Jahrbuch der Görres-Gesellschaft, Bd. xxix., 1908.) Size 9 × 5½, pp. 304–337. *Presented by Dr. O. Hartig.*

The late Dr. Stauber, during the preparation of a monograph on the Library of the fifteenth-century chronicler Hartmann Schedel (compiler of the 'Nuremberg Chronicle'), brought to light some interesting *data* bearing on the Portuguese discoveries of that century.

Historical—Cartography. **Denucé.**

Les origines de la cartographie portugaise et les cartes des Reinel. Par Jean Denucé. Ghent, 1908. Size 9½ × 6½, pp. viii. and 138. *Facsimile maps.*

Historical—Cartography. *Riv. G. Italiana* **15** (1908): 65–77, 135–148. **Magnaghi.**

L'Atlante manoscritto di Battista Agnese della Biblioteca Reale di Torino. Del Prof. Alberto Magnaghi.

Historical—Drake's Voyage. **Davidson.**

T. and P.G.S. Pacific **5** (1908): pp. iv. and 114.

Francis Drake on the north-west coast of America in the year 1579. The *Golden Hinde* did not anchor in the bay of San Francisco. By George Davidson.

Historical—Levant Company. **Epstein.**

The early history of the Levant Company. By Dr. M. Epstein. London: Routledge & Sons, [1908]. Size 8 × 5, pp. x. and 270. *Price 2s. 6d. net. Presented by the Publishers.*

Historical—Ophir. **Peters.**

Ophir nach den neuesten Forschungen. Von Dr. Carl Peters. Berlin: E. Felber, 1908. Size 8½ × 5½, pp. 36. *Price 1m. Presented by the Publisher.*

History of Geography. **Bellemo.**

Vincenzo Bellemo. La cosmografia e le scoperte geografiche nel secolo xvi. e i viaggi di Nicolo de Conti. Padua, 1908. Size 9 × 6, pp. 372. *Presented by the Author.*

BIOGRAPHY.

Pombal. **Aranha.**

O Marquez de Pombal e o seu centenario. Notas bio-bibliographicas . . . por Brito Aranha. Lisbon, 1908. Size 9 × 6, pp. 182. *Portrait and Illustrations. Presented by the Lisbon Geographical Society.*

Spilbergen. *Ts. K. Nederland. Aardr. Genoots.* **25** (1908): 513–550. **Wichmann.**

Joris van Spilbergen, 1568–1620. Door Arthur Wichmann. *Facsimile Illustration.*

The text of this dissertation is the recent Hakluyt Society edition of the voyages of Spilbergen and Le Maire, which the writer considers to do imperfect justice to its theme.

Towson. *Globus* **93** (1908): 325–330, 346–351, 363–366. **Seidel.**

Robert Towson, ein Tatraforscher des 18 Jahrhunderts. Von H. Seidel. *Illustrations.*

GENERAL.

Berlin Geographical Society. *Z. Ges. E. Berlin* (1908): 369–376, 396–402.

Fest-Sitzung zur Feier des 80-jährigen Bestehens der Gesellschaft für Erdkunde zu Berlin am 23. Mai 1908. Ansprache des Vorsitzenden. [Dr. Herr Hellmann.] Verkündigung der Ehrungen. *Also separate copy* (size 10 × 6½).

British Empire—Cotton.

The British Cotton Growing Association. Third annual report for the sixteen months ending December 31st, 1907. Manchester, 1908. Size 8½ × 5½, pp. 40. *Map and Illustrations.*

Early Work on Cosmography. **Waldseemüller and Wieser.**

Die Cosmographiæ Introductio des Martin Waldseemüller (Ilacomilus), in Faksimiledruck herausgegeben mit einer Einleitung von Fr. R. v. Wieser. Strassburg: J. H. Ed. Heitz, 1907. Size 8½ × 6½, pp. 30 and 104. *Facsimile Diagrams. Price* 10*m.*

An excellent facsimile reproduction of the whole work.

Education. *M. k.k. G. Ges. Wien* **51** (1908): 91–125. **Hödl and others.**

Fachsitzung am 17. Februar 1908 betreffend den geographischen Unterricht an Mittelschulen. [Address by Dr. Roman Hödl, and discussion.]

Educational. **Hubbard.**

College geography. By George D. Hubbard. (Reprinted from the *Educational Review*, New York, April, 1908.) Size 9½ × 6, pp. 381–400.

Educational—Text-book. **Johnston and Keane.**

A physical, historical, political, and descriptive geography. By Keith Johnston. 6th edit. Revised by Dr. A. H. Keane. London: E. Stanford, 1908. Size 8 × 5½, pp. xiv. and 492. *Maps and Diagrams. Price* 12*s. Presented by the Publisher.*

This well-known text-book appears in essentially the same guise as in the earlier editions, the revision having been restricted to matters of detail.

Educational—Text-book. **Lyde.**

A school text-book of geography. By Lionel W. Lyde. London: A. & C. Black, 1908. Size 7 × 4½, pp. xii. and 410. *Sketch-maps and Diagrams. Price* 3*s.* 6*d. Presented by the Publishers.*

Geography. *B.S.G. Lyon*, 2 Sér. 1 (1908): 1–11. **Martonne.**

Le développement et l'avenir de la géographie. Par E. de Martonne.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Islands—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from August 1 to 31, 1908.

1-inch (third edition):—
With hills in brown or black, 112, 113, 114, 115, 116, 141, 143, 166, 176, 201, 292, 293. 1*s. each* (engraved).

Large-sheet series, printed in colours, folded in covers or flat in sheets, 43, 52, 60. *Price, on paper,* 1*s.* 6*d.; mounted on linen,* 2*s.; mounted in sections,* 2*s.* 6*d. each.*

6-inch—County Maps:—
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25-inch—County Maps:—
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13; XL. 2, 9; **Yorkshire (First Revision of 1891 Survey)**, CLXXXI. 8, 11, 16 (1*s.* 6*d.*); CCII. 4, 8, 12, 16; CCIII. 5, 9, 11, 13, 14; CCXVI. 1, 2, 4, 8; CCXVIII. 6. 3*s. each.*

(*E. Stanford, London Agent.*)

British Islands—Scotland. **Bartholomew.**

Bartholomew's District Plan of Glasgow. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Edinburgh: J. Bartholomew & Co., [1908]. *Price 2s. mounted on cloth. Presented by the Publisher.*

Europe. **Andrews and Dickinson.**

Macmillan's Orographical Map of Europe. Designed by A. W. Andrews, M.A., and B. B. Dickinson, M.A. Scale 1 : 4,000,000 or 1 inch to 63·1 stat. miles. With Notes. London: Macmillan & Co., [1908]. *Price, mounted on rollers and varnished,* 15*s.*; *Notes,* 1*s. Presented by the Publisher.*

The relief is shown on this map by the ordinary colour-tinting system in a series of six shades of green, yellow, and brown, ranging from land below sea-level to over 6000 feet in altitude. Ocean depths are indicated by tints of blue at intervals of 100, 500, 1000, and 2000 fathoms. The intervals selected to show land relief, generally speaking, bring out the leading features of the great natural divisions of the continent fairly satisfactorily, but owing to the fact that the tint is the same between sea-level and 600 feet, the characteristic features of certain districts are almost lost, and perhaps it might have been an advantage if the high peaks had been indicated in some special manner instead of showing all land above 6000 feet by the same tint. Very properly there are but few names, and those that are given are small, so that the physical features are not obliterated, and stand out clearly when the map is hung on the wall of a classroom. Accompanying the map is an instructive little pamphlet of thirty pages, in which the various natural divisions of Europe, as shown on the map itself, are described. This also contains useful hints to teachers on the use of the map.

Sweden. **Generalstabens Litografiska Anstalt, Stockholm.**

Generalstabens Karta öfver Sverige. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 63, Umeå, N.O.; 63, Umeå, S.O.; 64, Holmön, N.V.; 64, Holmön, S.V.; 68, Sollefteå, N.V.; 80, Brämö, N.V.; 80, Brämö, S.V. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Sheet 80, Brämö. Stockholm: Generalstabens Litografiska Anstalt, 1907-08. *Presented by the Chef du Service Topographique, Stockholm.*

ASIA.

Indo-China and Siam. **Commission de Délimitation entre l'Indo-Chine et le Siam.**

Carte de la Commission de Délimitation entre l'Indo-Chine et le Siam. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Sheets: MoKrat, Grand Lac, Phnom Coulen, Dangrek, Khong, Bassac, Nam Heung, Pak-Lay, MoNan, Haut Mé-Nam, MoKhop—MoXieng Lom. Paris: Henry Barrère, [1908]. *Presented by the Publisher.*

An important map of the frontier region between Indo-China and Siam, constructed from the recent surveys of French officers attached to the commission for the delimitation of this boundary. The basis of the map is a system of triangulation, and carefully observed and computed latitudes and azimuths wherever these could be obtained. As regards longitude four methods were employed: first, difference of longitude computed from the astronomical azimuths; second, route traverses checked by latitudes; third, by transport of chronometers around closed traverses; fourth, absolute longitudes depending on the moon's movement, repeated in the same place. The first method was wisely adopted as far as possible. The latitudes were computed in five different ways, and the probable error of these observations, as well as that of the longitudes depending upon the azimuths, is stated to be less than five seconds of arc. It is evident that great care has been taken to provide as good a basis for this map as possible under the circumstances. The topographical features have been filled in by plane-table, or, where the country was not suitable for using this instrument, by traverses adjusted to fixed positions.

The sheets measure 17 inches by 25 inches, and are carefully drawn and printed in colours, land elevations being shown by contours, more or less approximate, at intervals of 50 metres.

AFRICA.

Egypt. **Survey Department, Cairo.**

Topographical map of Egypt. Scale 1 : 50,000 or 1·6 inch to 1 stat. mile. Sheets: N.E. III.–II., Mina el Qamh. S.E. IV.–I., Wasta; IV.–II., Masged Musa; V.–I., Beni Suef; VI.–I., El Baranqa. S.W. III.–III., Qasr Qarun; IV.–III., Bahr el Wakil; VI.–I. and II., Beba; VII.–I., Maghagha; VII.–II., Barmasha; VIII.–I., Beni Mazar; VIII.–II., Bardanuha. Cairo: Survey Department, 1908. *Presented by the Director-General, Survey Department, Cairo.*

Gold Coast. **Guggisberg.**

Map of the Gold Coast. Published by the authority of Sir John Pickersgill Rodger, K.C.M.G., Governor, under the direction of Major F. G. Guggisberg, R.E., F.R.G.S., Director of Surveys, Gold Coast. Scale 1 : 125,000 or 1 inch to 1·9 stat. mile. Sheets: 72-I–II., Debiso; 72-I–IV., Dadiaso; 72-J–III., Asafo; 72-O–II., Yaou; 72-O–IV., Newtown; 72-P–I., Enchi. Edinburgh and London: W. & A. K. Johnston, Ltd., 1908. *Price 2s. each sheet. Presented by Major F. G. Guggisberg, R.E., Director of Surveys, Gold Coast.*

Morocco. **Larras.**

Cartes de Reconnaissance du Maroc levées et dessinées par le Capitaine N. Larras, 1898–1906. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: Fès; Mazagan. Paris: Henry Barrère, [1908]. *Presented by the Publisher.*

In addition to the usual topographical features and route surveys, these sheets contain plans of Rabat-Salé (1 : 30,000) and Mazagan (1 : 10,000). The positions of wells and cisterns, and other information useful for travellers, have been carefully noted.

Morocco. **Service Géographique de l'Armée, Paris.**

Carte du Maroc. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. Sheets: 3, Qudjda; 5, Oued Charef. Paris: Service Géographique de l'Armée, 1906–7. *Price 1 fr. each sheet.*

Two sheets of a large-scale coloured map of Morocco of which the publication was commenced two years ago. The present sheets include Melilia and the country to the south and east as far as the frontier of Algeria.

Togo. **Sprigade.**

Karte von Togo. Bearbeitet von P. Sprigade. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Sheet C 2, Sokodé. *Mitteilungen aus den deutschen Schutzgebieten.* Band xxi., 1908, Karte 7. Berlin: E. S. Mittler & Sohn, 1908. *Presented by Dietrich Reimer's Geographical Establishment, Berlin.*

The second revised edition of the sheet published in August, 1905. The geographical results of several additional route surveys have been added.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 20, Souris, revised to May 12, 1908; 24, Lake of the Woods, revised to May 12, 1908; 170, Yorkton, revised to February 19, 1908; 220, Nut mountain, revised to December 11, 1907. Ottawa: Department of the Interior, Topographical Surveys Branch, 1907–1908. *Presented by the Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Ottawa.**

Map of the Dominion of Canada. Scale 1 : 6,336,000 or 1 inch to 100 stat. miles. Ottawa: Department of the Interior, 1908. *Presented by the Department of the Interior, Ottawa.*

Canada. **Topographical Section, General Staff.**

Map of Canada. Scale 1 : 126,720 or 1 inch to 2 stat. miles. Sheet: Niagara peninsula, Ontario. London: Topographical Section, General Staff, War Office, 1908. *Price 2s. 6d. each sheet. Presented by the Director of Military Operations.*

A sheet of the new topographical map of Canada, based on surveys carried out by the Canadian Department of Militia and Defence. There are two editions of the sheet, one showing hill features by contours in brown at 25-feet intervals, and another indicating the relief of land by twelve different shades of brown at intervals of 50 feet from 200 feet to 900 feet. The area included extends from Lake Ontario in the north to Lake Erie in the south, while the Niagara river and the towns upon it, with the falls, form the eastern limit, and Hamilton and Caledonia the western. The sheet will be most useful to tourists and others visiting the district.

PACIFIC OCEAN.

Caroline Islands. **Krämer.**

Karte von Babeldáob nach provisorischen Aufnahmen von A. Krämer. Scale 1 : 225,000 or 1 inch to 3·5 stat. miles. Politische Uebersichtskarte der Yap-Inseln mit den von A. Krämer ermittelten Namen. Scale 1 : 150,000 or 1 inch to 2·4 stat. miles. *Mitteilungen aus den deutschen Schutzgebieten*, Band xxi., 1908, Karte 10. Berlin: E. S. Mittler & Sohn, 1908. ***Presented by Dietrich Reimer's Geographical Establishment, Berlin.***

These are maps of the two principal islands in the Pelew and Caroline groups in the possession of Germany. They contain a considerable amount of new information, although the surveys from which they were drawn are considered as provisional only.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during July, 1908. ***Presented by the Hydrographer, Admiralty.***

New Charts.

No.	Inches.	
2268 m =	9·0 and 14·2	England, south coast:—Portland harbour. Plan:—Portland coaling piers. 3*s.*
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1685 m =	0·3 and var.	Greece:—Venetico island to Spezzia island, including the channels between Cape Malea and Crete. Plans:—Kapsali bay, Port Asomato, Port Potamo, Port Vathy, St. Nikolo bay. 3*s.*
3201 m =	1·78 and 3·60	Iceland:—Approaches to Hafnarfiord and Reykjavik. Plans:—Hafnarfiord, Reykjavik harbour. 3*s.*
1127 m =	6·0	Canada, river St. Lawrence:—Montreal harbour. 3*s.*
3697 m =	1·3	Philippine islands:—Lucena anchorage, Pagbilao bay and Port Laguimanok. 2*s.*
1741 m =	3·0	China:—Chu kiang or Canton river, Sheet II.:—Langkit spit to Tiger island, including Chuen pi and Boca channels. 3*s.*
174 m =	0·33 and var.	New Hebrides:—Banks group. Plans:—Milli bay, Avreas bay, Lakona bay, Losolav anchorage, Masevonu anchorage. 2*s.*

New Plans and Plans added.

102 m =	17·7	England, east coast:—Pakefield Gatway to Orfordness. Plan added:—Southwold harbour, 2*s.* 6*d.*
3220 m =	13·2	France:—Cape Ferrat to Bordighera. Plan added:—Port Monaco. 4*s.*
106 m =	3·6	Sardinia. Palmas bay. Plan added:—Port Teulada. 2*s.*
1129 m =	3·6	Sardinia:—San Pietro channels, etc. New Plan:—Port Malfatano. 2*s.*
1556 m =	2·6	Ægean sea. Gulf of Volo with Oreos and Talanta channels. Plan added:—Ahillion anchorage. 4*s.*
957 m =	3·0	Ports in the Philippine islands. Plan added:—Agusan river entrance. 2*s.*
1414 m =	2·5	Anchorages in the Solomon islands. Plan added:—Neal island anchorage. 3*s.*

Charts Cancelled.

No.		
2268	England, south coast:—Portland harbour, Portland coaling piers.	New chart. Portland harbour, Portland coaling piers 2268
2609	France:—Rade d'Agay to San Remo, Plan of Port Monaco on this sheet.	New plan. Port Monaco on chart 3220
1685	Greece:—Venetico to Cape Malea with the island of Cerigo. Plans:—Kapsali bay, Port St. Nikolo, Port Vathy, Port Asomato, Port Potamo.	New chart. Venetico island to Spezzia island, including the channels between Cape Malea and Crete. Plans:—Kapsali bay, Port Asomato, Port Potamo, Port Vathy, St. Nikolo bay . 1685

2733 Iceland: — Portland to Snefells Jökel. Plan of Reykjavik and adjacent inlets on this sheet. 3201 Iceland: — Reykjavik harbour.	New chart. Approaches to Hafnarfiord and Reykjavik. Plans:—Reykjavik harbour, Hafnarfiord 3201
1127 Canada, River St. Lawrence:—Montreal harbour.	New chart. Montreal harbour 1127
2395 Ports in the Philippine islands:—Plan of Laguimanok bay on this sheet.	New chart. Lucena anchorage, Pagbilao bay, and Port Laguimanok 3697
1741 China. Canton river, sheet II.:—Langkit spit to Tiger island, with Chuen pi and Boca channels.	New chart. Chu kiang or Canton river, sheet II., Langkit spit to Tiger island, including Chuen pi and Boca channels 1741
856 Anchorages in the New Hebrides:—Plans of Masevonu and Losolav anchorages on this sheet. 174 New Hebrides. Banks group:—Milli bay, Avreas bay, Lakona bay.	New chart. Banks group:—Milli bay, Avreas bay, Lakona bay, Losolav anchorage, Masevonu anchorage 174

Charts that have received Important Corrections.

No. 1859, England, west coast:—King road. 3648, Africa, west coast:—Junk river to Cestos bay. 815, Ceylon:—Trincomali harbour and bays. 3588, China:—Canton river delta. 3026, China:—Macao to Pedro Blanco, including Hong Kong. 2412, Japan:—Amoy to Nagasaki. 3531, Tasmania:—Entrance to Macquarie harbour. (*J. D. Potter, Agent.*)

Chile. **Oficina Hidrografica, Valparaiso.**

Chilian Hydrographic Charts, Nos. 117, Tierra del Fuego, Canal Beagle; 137, Magallanes, Bahia Porvenir; 141, Coquimbo, Bahia Choros e islas adyacentes; 143, Tierra del Fuego, Paso Timbales, Canal Beagle. Valparaiso: Oficina Hidrografica, 1907-08. *Presented by the Chilian Hydrographic Office.*

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, September, 1908. London: Meteorological Office, 1908. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, September, 1908. London: Meteorological Office, 1908. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, August, September, 1908. Washington: U.S. Hydrographic Office, 1908. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, September, 1908. Washington: U.S. Hydrographic Office, 1908. *Presented by the U.S. Hydrographic Office.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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